

DOCUMENT RESUME

ED 037 521

08

VT 007 182

AUTHOR Miller, Dwane G.; And Others
TITLE Transparency Masters for Crop and Weed Identification. Final Report.
INSTITUTION Washington State Coordinating Council for Occupational Education, Olympia.; Washington State Univ., Pullman.
SPONS AGENCY Office of Education (DHEW), Washington, D.C.
BUREAU NO BR-7-0031
PUB DATE Jun 68
GRANT OEG-4-7-070031-1626
NOTE 220p.

EDRS PRICE EDRS Price MF-\$1.00 HC-\$11.10
DESCRIPTORS Agronomy, Instructional Materials, *Plant Identification, *Plant Science, Research Projects, *Transparencies, *Vocational Agriculture, *Weeds

ABSTRACT

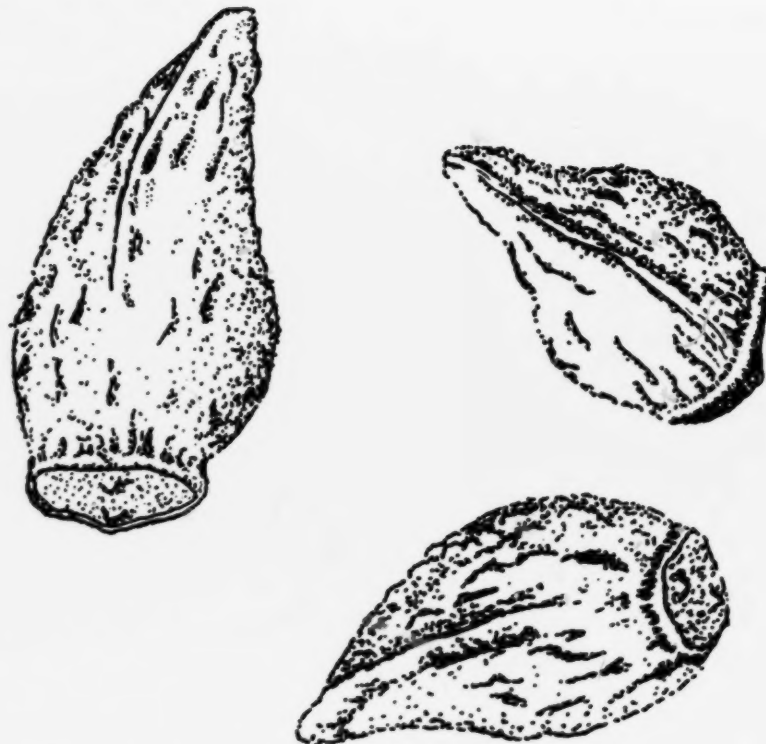
Instructional aids produced from these transparency masters and the accompanying narrative may be used by vocational agriculture teachers in presenting courses in plant science. They were developed by subject matter specialists and teacher educators as part of a project designed to test effects of involving vocational agriculture teachers in development and experimental use of instructional materials. Included with the transparencies are introductory material on the project, the method of research, and the results, as well as recommended uses of the masters and teaching suggestions. The transparencies are grouped under five subject areas: (1) General Plant Morphology and Structure, (2) Cereal Crops, (3) Legumes, (4) Grasses, and (5) Weed Identification. Samples of letters and questionnaires used in the research are appended. (AW)

ED037521

TRANSPARENCY MASTERS

FOR

CROP AND WEED IDENTIFICATION



U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE
PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS
STATED DO NOT NECESSARILY REPRESENT OFFICIAL OFFICE OF EDUCATION
POSITION OR POLICY.

Cooperative Contributions from Vocational-Technical
Education Research and Development Project, Depart-
ment of Education, Department of Agronomy, Washing-
ton State University. Coordinating Council for Occupa-
tional Education, Agricultural Education, Olympia,
Washington. Washington State Research Coordinating
Unit for Vocational Education, Olympia, Washington.

1968

VT007182

1
TRANSPARENCY MASTERS FOR CROP
AND WEED IDENTIFICATION, FINAL REPORT

Transparency masters for teaching plant science.

Final Report
Project No. OE7-0031
Contract No. OEG-4-7-070031-1626

2
Dwane G. Miller, Agronomy
Gilbert A. Long, Education
Clarence E. Manning, Agronomy

June 1968

The research reported herein was performed pursuant to a contract with the Office of Education, U. S. Department of Health, Education, and Welfare. Contractors undertaking such projects under Government sponsorship are encouraged to express freely their professional judgment in the conduct of the project. Points of view or opinions stated do not, therefore, necessarily represent official Office of Education position or policy.

4
Washington
Department of Education, Washington State University, Pullman, Washington.
State Coordinating Council for Occupational Education, Olympia, Washington.
Department of Agronomy, Washington State University, Pullman, Washington.

CONTENTS

LIST OF ILLUSTRATIONS	iii
LIST OF TABLES	vi
ACKNOWLEDGMENTS	vii
SUMMARY	1
INTRODUCTION	
Purpose	2
Related Research	2
METHOD	3
RESULTS	4
DISCUSSION	4
RECOMMENDED USES OF MASTERS	
Suggested Teaching Strategy	5
Student Participation	5
Narrative Description	6
Presentation	6
NARRATIVE	8
TRANSPARENCY MASTERS	
Section I: General Plant Morphology and Structure	17
Section II: Cereal Crops	59
Section III: Legumes	93
Section IV: Grasses	105
Section V: Weed Identification	136
APPENDICES	210

LIST OF ILLUSTRATIONS

SECTION I: GENERAL PLANT MORPHOLOGY AND STRUCTURE

Monocot Seed	19
Dicot Seed	21
Inflorescence Types	23
Typical Dicot Flower	27
Typical Monocot Flower	29
Legume Flower	31
Wheat Spikelet	33
Caryopsis	33
Palea	34
Lemma	35
Glumes	36
Meristematic Regions	37
Common Sheath and Ligule Types	39
Stolon: A Specialized Stem	41
Rhizome: An Underground Stem	43
Simple Broad Leaf	45
Simple Palmately Compound Leaf	47
Simple Pinnately Compound Leaf	49
Typical Trifoliolate Legume Leaf	51
Narrow Grass Leaf	53
Tap Root System	55
Fibrous Root System	57

SECTION II: CEREAL CROPS

Vegetative Characteristics of Cereals	61
Brush Lengths	63
Brush Sizes	65
Cheek Shapes	67
Crease Widths	69
Crease Depths	71
Kernel Shapes	73
Hard Red Winter Wheat	75
Hard Red Spring Wheat	77
Soft Red Winter Wheat	79
White Club Wheat	81
Amber Durum Wheat	83
Red Durum Wheat	85
Oat Seed	87
Barley	89
Rye	91

SECTION III: LEGUMES

Alfalfa	95
Sweetclover	96
Red Clover	97
White Clover	98
Alsike Clover	99
Strawberry Clover	100
Subterranean Clover	101
Crimson Clover	102
Hairy Vetch	103
Birdsfoot Trefoil	104

SECTION IV: GRASSES

Prospective view of the various parts of the grass	
inflorescence showing levels of development	107
Kentucky Bluegrass	108
Big Bluegrass	110
Bulbous Bluegrass	112
Smooth Bromegrass	113
Mountain Bromegrass	115
Tall Fescue	117
Red Fescue	119
Orchardgrass	121
Intermediate Wheatgrass	123
Crested Wheatgrass	125
Perennial Ryegrass	127
Tall Oatgrass	129
Reed Canarygrass	131
Red Top	133
Timothy	135

SECTION V: WEEDS

Canada Thistle	138
Dalmatian Toadflax	140
Leafy Spurge	142
Quackgrass	144
Russian Knapweed	146
Skeleton Weed	148
White Top	149
Wild Morning-Glory	151
Buckhorn Plantain	153
Dodder	155
Curly Dock	157
Fanweed	159
Klamath Weed	161
Goatweed	162
Puncture Vine	163
Sheep Sorrel	165

SECTION V: WEED IDENTIFICATION (Continued)

Wild Oats	167
Yellow Starthistle	169
Black Nightshade	171
Bachelors Button	173
Cow Cockle	174
Bull Thistle	176
Dog Fennel	178
Downy Bromegrass	180
Cheatgrass	181
Gromwell	182
Henbit	183
Jim Hill Mustard	185
Knotweed	187
Prostrate Knotweed	188
Lambs-Quarters	189
Mallow	191
Mares-Tail	193
Prickly Lettuce	195
China Lettuce	196
Rough Pigweed	197
Pigweed	198
Russian Thistle	199
Salsify	201
Wild Salsify	202
Tarweed	203
Wild Buckwheat	205
Yarrow	207
Hairy Vetch	209

LIST OF TABLES

TABLE 1

Media Identified as Preferable by Vocational Agriculture Teachers	3
--	---

TABLE 2

Agronomic Areas of Interest Identified by Vocational Agriculture Teachers	4
--	---

ACKNOWLEDGMENTS

Special appreciation is due Ernest G. Kramer, Assistant State Superintendent of Vocational Education, and Bert Brown, State Director of Agricultural Education.

We thank Stanford Sleeth for his suggestions regarding the technical layout of the transparencies.

Appreciation is also due Al Law, Professor of Agronomy, for review of the materials presented.

Our thanks to Sharon Day for careful copy editing and preparation of this manuscript.

SUMMARY

The purpose of this project was to test effects of involving vocational agriculture teachers in development and experimental use of instructional materials.

Teachers in the field identified their agronomy curriculum needs. Subject matter specialists cooperated with teacher educators to develop this set of transparencies and accompanying narrative. Returns of questionnaires (Appendix B) indicate that 93 per cent of Washington vocational agriculture teachers have used the previous transparencies during the 1967-68 school year. An additional 2 per cent indicate that they want to use the masters as soon as equipment is available.

INTRODUCTION

Purpose

"Transparency Masters for Teaching Crop Science," is the third study to ascertain the effects of involving teachers in curriculum development. The purpose of this project is to continue to study the effects of involving teachers in development of visual instructional material. This study also explores the value of cooperation between agriculture teacher educators and academic subject matter experts in the development of instructional materials.

Related Research

Vocational teacher supervisors seeking to stimulate curriculum development and use of modernized instructional materials have long recognized the values of involvement. Psychologists and sociologists have researched processes by which involvement increases interest and a sense of identification with new developments and a desire to participate in their use. Curriculum supervisors have explored arrangements and processes designed to enlarge dimensions of participation in developmental processes.

The rationale for this experiment was derived from research indicating the influence of group effort and resultant group relationships on (1) participation, (2) the sense of identification derived from participation, and (3) the effects of participation and personal identification on use of innovations.

The research and observations of Katz and Lazarsfeld¹, Cohen², and Sherif and Hovland³ indicate that cognitive and personal involvement in a process (1) enlarges peoples' sense of identity, (2) increases their comprehension, (3) stimulates purposeful personal effort, and (4) activates a will to pursue purposes derived from consensus of group

¹Katz, Elihu, and Paul F. Lazarsfeld, Personal Influence, Free Press, 1955.

²Cohen, Arthur R., Attitude Change and Social Influence, Basic Books, 1964.

³Sherif, Muzafer, and Carl I. Hovland, Social Judgment, Yale University Press, 1961.

thought. Zander and Medow⁴ add evidence that improvements of performance impel individuals and groups to continue sustained efforts to make further improvements.

METHOD

Personal inquiries were made of the state supervisors by the author. Their suggestions were included in the development of the transparencies.

Suggestions from teachers for this third phase of the project were obtained by mail. Fifteen teachers responded to inquiries (See Appendix A). Teacher suggestions as shown in Tables 1 and 2 were used in the development of this series of transparency masters.

TABLE 1

Media Identified as Preferable by
Vocational Agriculture Teachers

Media	Media Preference
Slides	11
Transparencies	10
Workbook	3
Film	2
Chart	1
Film Strip	1
Audio Tape	1

⁴Zander, Alvin and Herman Medow, "Individual and Group Levels of Aspirations," Human Relations, 16:89-104, February, 1963.

TABLE 2

**Agronomic Areas of Interest Identified by
Vocational Agriculture Teachers**

Area	Areas Preferred
Legumes	12
Grasses	7
Weeds	6
Soils	3
Grain Crops	2
Seeds	2
Plant Reproduction	2
Fertilization	1
Root Types	1
Cereals	1

RESULTS

State supervisor and individual teacher reports indicate a strong and increasing interest in specific instructional aids. Workshops, follow-up questionnaires soliciting the teachers' suggestions for refinement of field tested materials, and the continued involvement of teachers in development and testing of new materials have resulted in development of a substantial number of transparency masters.

Returns of questionnaires (see Appendix B) indicate that 93 per cent of Washington state vocational agriculture teachers have used the masters during the 1967-68 school year. An additional 2 per cent indicate that they want to use the masters as soon as equipment is available.

Fifteen teachers indicated their specific interest in transparencies and slides in an agronomic curriculum (See Tables 1 and 2).

DISCUSSION

This project indicates that the effects of involvement hypothesized on the basis of the research and concepts of Katz, Lazarsfeld, Cohen, Sherif, Hovland, and Zander do materialize. Continued involvement of teachers does seem to increase teachers' interest in cooperative work on instructional materials. The vocational agriculture teachers in Washington state are actively using a variety of instructional media. This pursuit and use of the best instructional materials available plus the involvement of large numbers of teachers in workshop meetings offers promise of keeping vocational instruction applicable to current needs.

RECOMMENDED USES OF MASTERS

Suggested Teaching Strategy

Transparencies can be used in many ways by the agriculture teacher. The transparency masters in this unit are designed to enable the teacher to approach a multi-media system of instruction.

The instructional strategy that includes the technique most appropriate to commonly held objectives for teaching, identification, and classification of economic crops will in the authors' opinion include colored transparencies. For this reason these transparency masters have been duplicated on tracing paper. Tracing paper enables the production of colored transparencies by the Diazo process.⁵

A colored transparency or slide will most closely approximate the actual conditions necessary for teaching objectives that include discrimination between plant or seed varieties. Living or mounted plant materials would continue to be the primary instructional media and this set of transparency masters would supplement them. These transparencies can be incorporated with slides, programmed instruction, discussion, and demonstrations to provide the instructional manager with more media from which to make choices.

The instructor is expected to provide local application of this instructional material. Transparencies lend themselves to editing. The instructional manager should make timely changes in the transparency masters to update and refine them for his teaching objectives.

⁵Long, Gilbert A., Joel H. Magisos, and Stanford Sleeth, Transparency Masters for Agriculture (Supplement), Department of Education, Vocational-Technical Education Research and Development Project, Washington State University and State Board for Vocational Education, Olympia, May, 1967.

Student Participation

These masters lend themselves well to use by students in classroom reports and speech presentations. They permit individual student review or testing.

The masters are additionally appropriate for Future Farmers of America activities, such as TV shows. They provide good raw material for graphic artists to help demonstrate chapter activities.

Narrative Description

The narrative included with this material, Pages 8-16, can be utilized to prepare audio tapes to supplement the transparency masters, or the teacher can use this narrative as a script accompanying the transparencies.

Presentation

The development of this set of transparencies has been based upon a need for limiting the material presented on each transparency and the realities of cost for preparation of each transparency. Lead lines are on one side of the object projected to enable the instructor to use the step method of revealing each item illustrated in the overhead projection transparency. The teacher is encouraged to modify these masters to fit his particular needs. For a review of overhead transparency duplication and usage see "Transparency Masters for Agriculture (Supplement)"⁶ or any of the many current publications available.

The agriculture teacher is encouraged to design a system of instruction that will serve as the best resource for attaining his objectives. Further development of this "instructional system" may well be implemented by the teacher in the field by developing audio tapes of a field man, or a seed grader or similarly employed agronomy service personnel. This could serve to introduce the vocational opportunities available in the agronomy field. Additional interest will result from this interview of a person whose work demonstrates a need for knowledge of agronomy.

In developing this series of transparencies, our objectives were to illustrate the basic plant parts, their shape, structure, and function which would enable the student to better understand the terminology used to describe specific plant parts used in identification of crops and weeds. To become familiar with the general aspects of plant identification, we recommend coverage of Section I first. The remaining sections may be arranged in any logical order according to the desires of the instructor and his respective learning program.

⁶Ibid.

While these aids demonstrate the basic principles of plant structure, they are designed only to supplement, rather than replace, actual living or mounted plant specimens. Teachers will find these instructional aids most useful to further the interest and understanding of students for crop and weed identification and other basic agronomic principles. These principles can then be applied to field performance. Utilization of these instructional aids conjugated with living material provide a flexible instructional system.

NARRATIVE

SECTION I: GENERAL PLANT MORPHOLOGY AND IDENTIFICATION

PAGE
19

1. The Seed:

Nearly all economic crops grown by the farmer, and the weeds which infest his fields belong to the group of plants called Angiosperms. This group is further subdivided into Monocotyledons, which have one cotyledon or seed leaf per embryo, and Dicotyledons, which have two cotyledons. These two transparencies show vertical cross-section views through a monocot and dicot seed with the important parts of each labeled.

2. Inflorescence Types:

23

The cluster or arrangement of flowers of a plant is known as an inflorescence. Inflorescence type, shape, and structure are often used to separate and identify various crops and weeds. These transparencies present the five basic inflorescence types: spike, panicle, raceme, head, and umbel.

3. Flower Types:

27

Seeds of flowering plants begin their development in a structure known as the flower (floret in grasses). The flower, in addition to other structures, contains the sexual parts of the plant, the stamens, (male structures) in which the pollen develops, and/or the pistle, (female structure) which encloses the ovary or developing egg. These transparencies show typical flowers found in monocots and dicots with the important parts labeled.

4. The Legume Flower:

31

Legumes are dicotyledons and many have a very distinct flower type as shown on this transparency. The five petals (calyx) of this flower are irregular in shape and form the five basic parts.

5. The Wheat Spikelet:

33

Grass plants are monocotyledons having a much reduced and modified flower. The sepals and petals have been reduced to papery bracts. This transparency shows the basic parts of a typical grass flower in such a way that they may be put together to form a multiple type transparency.

6. Meristematic Region:

37

Meristematic regions are those areas where cell division occurs and where plant growth is initiated. In woody and herbaceous dicots this region is at the tip of the developing shoot. In monocots, growth is initiated in an area just above the last developed node on the stem. These two types are illustrated in this transparency with regions labeled.

7. Sheath and Ligule Types:

39

Most grasses can be identified by basic structural differences. Some vegetative differences are noted in ligule shape and size, and in the type of leaf sheath. These characteristics when coupled with such things as leaf shape, texture, auricle size, pubescence, and other vegetative characteristics can serve to identify many of the grasses. This transparency shows some basic vegetative characteristics found in many of the various grass plants.

8. Specialized Stems:

41

In some plants, stems have been modified to provide for asexual reproduction or propagation. If the stem creeps above the ground, developing roots and shoots at the point (nodes) where it touches the ground, it is known as a stolon. If the stem develops underground, and roots and shoots arise from the nodes, it is known as a rhizome. Many difficult weeds to control, as well as grasses and legumes, spread by rhizomes and stolons. These transparencies show the differences in their formation and are labeled to show the main parts.

9. Leaf Types:

45

All plants have characteristic leaf types which aid in their identification. Once a general leaf type has been identified, many other characteristics of the individual leaf are utilized for final identification. Several basic leaf types appear in these transparencies.

10. Legume Leaf:

51

Legumes are important agronomic plants having trifoliate leaves consisting of three leaflets. This is the primary leaf characteristic of the true clovers, sweetclover, and alfalfa. This transparency shows a typical legume leaf with parts labeled.

11. Grass Leaf:

53

Grasses are the most important agronomic plants belonging to the narrow-leafed group. Most grass leaves have only one blade with the other parts being highly modified from that of a typical broad leaf. A type grass leaf is diagrammed in this transparency.

12. Root Systems:

55

Most plants have either a fibrous root system as found in the grasses, or a tap root system such as that of many legumes. These transparencies describe the principle differences between these two types of root systems.

SECTION II: CEREAL CROP IDENTIFICATION**1. Leaf Vegetable Characteristics of Cereal Grains:**

61

This transparency shows several important characteristics which aid in separating the more common cereal plants. These features can be used at a very early growth stage before heading.

2. Morphology of the Wheat Seed:

63

This series of transparencies shows in diagrammatic form the general morphological and structural characteristics of the wheat kernel.

3. Market Classes of Wheat:

75

Wheats can successfully be identified as to market class by kernel shape and structure, and by brush, check, and crease types. These transparencies illustrate seed characteristics common to the various wheat market classes.

4. Oat Seed:

87

This transparency shows the main identifying characteristics between cultivated and wild oats with parts labeled.

5. Barley:

89

This transparency illustrates the major differences between 2-rowed and 6-rowed barley seed. This difference is difficult to recognize at first but it can be observed with practice.

6. Rye:

91

The factors distinguishing rye from wheat are noted in this transparency.

SECTION III: LEGUME IDENTIFICATION

These transparencies are designed to show the leaf characteristics, stipule shape and size, and other recognizable features of the fully developed legume leaf for several common forage types.

A drawing of the seedling is included to show early structural differences at the first trifoliolate leaf stage. There are no parts labeled in these drawings because labels in Section I for the typical legume leaf are applicable here.

1. Alfalfa:

95

The terminal leaflet of the trifoliolate leaf is supported on an elongated stalk (petiolar branch) and the margin is serrated at the tip.

⁷The soft red winter overlay can be used for soft white wheat.

	PAGE
2. Sweetclover:	96
The terminal leaflet of the trifoliolate leaf is supported on an elongated stalk, and the leaflet is serrated along $\frac{2}{3}$ of its margin.	
3. Red Clover:	97
Leaflets are sessile on the petiole representing a true <u>trifolium</u> leaf. Leaflets are large, pubescent along the margin, and have a light-colored water mark. The tips of the leaflets are usually pointed. Stipules are large and heavily purple veined. Petioles are heavily pubescent.	
4. White Clover:	98
Sessile leaflets arise on a long petiole from a prostrate stem (stolon). The leaflet is heart shaped or notched at the tip and has a light-colored water mark. Vegetative parts are not pubescent.	
5. Alsike Clover:	99
Sessile leaflets are minutely serrated around the entire margin and are very finely veined. Stipules are long and taper at the tip with light green or white-colored veins. No pubescence is evident on vegetative parts.	
6. Strawberry Clover:	100
Sessile leaflets without water marks are borne on long petioles from a creeping stem (stolon). Leaflets have thick parallel veins which are conspicuous at the margin. Pubescence of vegetative parts is usually lacking.	
7. Subterranean Clover:	101
Sessile leaflets arise from short petioles from a prostrate stem (stolon). The leaflets are notched at the tip, heart shaped, and pubescent. A water mark is lacking, and the leaves and stems are softly pubescent.	

	PAGE
8. Crimson Clover:	102
Sessile leaflets arise from an upright stem on long petioles, and they lack a water mark. Both leaflets and petiole are pubescent. Stipules are large, broad, and with distinct purple margins.	
9. Hairy Vetch:	103
Leaves are pinnately compound and contain 10 to 20 leaflets alternately arranged on a central axis. Tendrils are present. Petioles, axis, and leaflets hairy or highly pubescent.	
10. Birdsfoot Trefoil:	104
In this legume there are actually three leaflets per leaf, however, the stipules resemble leaves presenting the appearance of five leaflets, three apical and two basal. Pubescence of vegetative parts is lacking.	

SECTION IV: GRASS IDENTIFICATION

These transparencies show the inflorescence, spikelet, and a dorsal-ventral view of the caryopsis for several grass types. The most easily observed characteristics were drawn as outline sketches with much elimination of detail. The spikelet and seeds illustrated are enlarged to fully demonstrate several minute identifying features. Observation of living material should accompany these transparencies, to gain experience in recognizing the various points as they actually exist. Many of the following features are difficult to see and can be mastered only with considerable practice and observation.

1. Kentucky Bluegrass:	108
Panicle is open with lower branches in whorls of five. The spikelet contains many florets and is much flattened, resulting in compressed seeds. Seeds have a thin hood projecting around the upper half of the seed, and webbing, representing sterile florets, may be present at the base.	

	PAGE
2. Big Bluegrass:	110
Panicle is much tighter than Kentucky bluegrass but is larger in overall size with the spikelet less compressed and more open. The seed shows a thin hood extending around its upper portion and is toothed along the back rib.	
3. Bulbous Bluegrass:	112
Seed is lacking and replaced by bulblets, which are often bluish to purple in color. Matures very early in the spring. Bulbs develop rapidly into new plants, since seed germination is eliminated. Inflorescence is a panicle.	
4. Smooth Brome grass:	113
Panicle is more open with spikelets long, narrow, and tight usually containing 3-6 seeds. The seed is very flat and papery, with a blunt tip, and with a small awn at the apex. The rachilla is large and pubescent.	
5. Mountain Brome grass:	115
The spikelet is large and may be sticky. The seed is long, narrow, and sharp tipped with a long awn. The leaf may be very harsh and prickly to the touch.	
6. Tall Fescue:	117
The inflorescence, a panicle, is larger than red fescue with tighter spikelets. The seed is boat shaped with a knobbed rachilla and with spines along the veins of the lemma.	
7. Red Fescue:	119
The spikelet is open and rather large. The seed is boat shaped with a short awn. The inner edge of the palea is toothed, and the lemma is smooth. A knobbed rachilla is present.	
8. Orchardgrass:	121
The spikelet is small, very dense, and develops in tight clusters within the panicle. The seed is curved with fine hairs along the mid vein of	

- PAGE
8. Orchardgrass: (Continued) 121
- the lemma, terminating in a short curved awn. Rachilla is present, but not knobbed. Stems are much flattened, especially at the base.
9. Intermediate Wheatgrass: 123
- The inflorescence is a spike. Spikelets are loosely structured and arranged flatwise to the rachis, that is, the wide side of the spikelet faces the rachis of the spike. The seed has a small awn and a slightly knobbed rachilla. The palea has minute spines around the inner margin.
10. Crested Wheatgrass: 125
- The inflorescence is a spike usually in the shape of a pyramid. The seed has a short, broad rachilla, a toothed inner margin on the palea, and a spiny keel with a curved awn.
11. Perennial Ryegrass: 127
- The inflorescence is a spike, with spikelets arranged edgewise (in contrast to flatwise) to the rachis. The second glume is absent or compressed into the rachis leaving the appearance of only one glume per spikelet. The seed is boat shaped with a wedge-shaped rachilla and the inner margin of the palea is minutely toothed. Seed is similar to tall fescue in color and size except the rachilla is not knobbed.
12. Tall Oatgrass: 129
- The inflorescence is a large open panicle with one spikelet per pedicle. The spikelet contains two florets one of which is usually sterile. The awn is similar to that of wild oats--twisted and bent at the tip.
13. Reed Canarygrass: 131
- The inflorescence is quite dense and large with spikelets containing only one seed. The seed is shiny with minute hairs at the tip which may drop off as the seed dries.

	PAGE
14. Redtop:	133

The inflorescence is a definite pyramidal, open panicle which turns red with maturity. The glumes completely enclose the florets. The seed is small, narrow, pointed, and with no apparent rachilla. A tuft of fine hairs may be present at the base of the seed.

15. Timothy:	135
--------------	-----

The inflorescence is a very dense panicle and often resembles a cylindrical spike. The glumes are pronounced, awned and have minute teeth around the outside edge at the tip. Only one seed is contained within each pair of glumes.

SECTION V: WEED IDENTIFICATION

The following transparencies show the identifying plant and seed characteristics of several weeds in diagrammatic form. These drawings are intended only to demonstrate the features of various weeds and should be supplemented by examination of living plant specimens to become competent in weed identification. Specific descriptions related to identification of each weed appears on each of the following transparencies of this series.	138
--	-----

GENERAL PLANT MORPHOLOGY AND STRUCTURE

SECTION I

TRANSPARENCY MASTERS FOR CROP AND WEED IDENTIFICATION

Dwane G. Miller Gilbert A. Long Clarence E. Manning

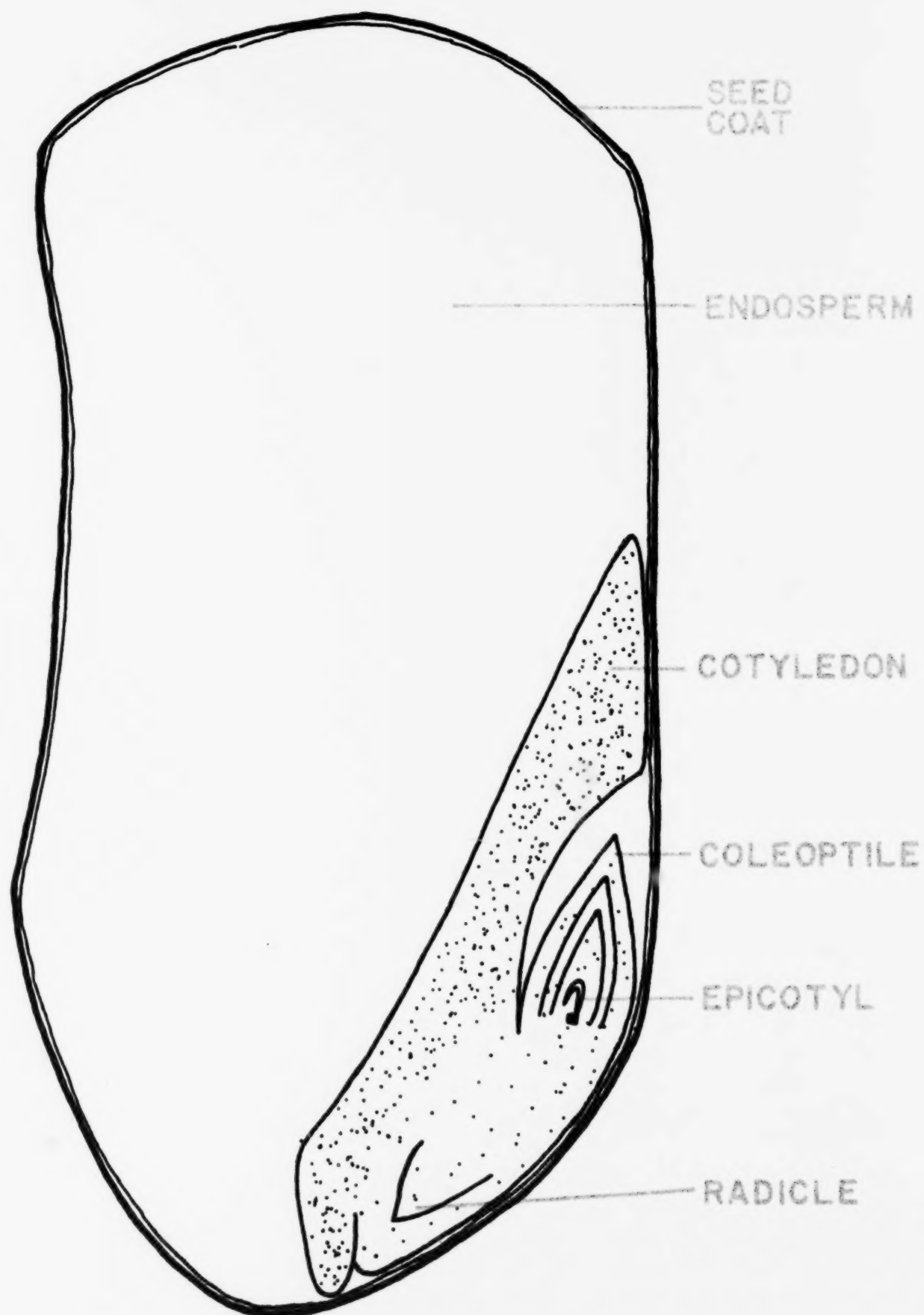
TABLE OF CONTENTS

SECTION I: GENERAL PLANT MORPHOLOGY AND STRUCTURE

Monocot Seed	19
Dicot Seed	21
Inflorescence Types	23
Typical Dicot Flower	27
Typical Monocot Flower	29
Legume Flower	31
Wheat Spikelet	33
Caryopsis	33
Palea	34
Lemma	35
Glumes	36
Meristematic Regions	37
Common Sheath and Legule Types	39
Stolon: A Specialized Stem	41
Rhizome: An Underground Stem	43
Simple Broad Leaf	45
Simple Palmately Compound Leaf	47
Simple Pinnately Compound Leaf	49
Typical Trifoliolate Legume Leaf	51
Narrow Grass Leaf	53
Tap Root System	55
Fibrous Root System	57



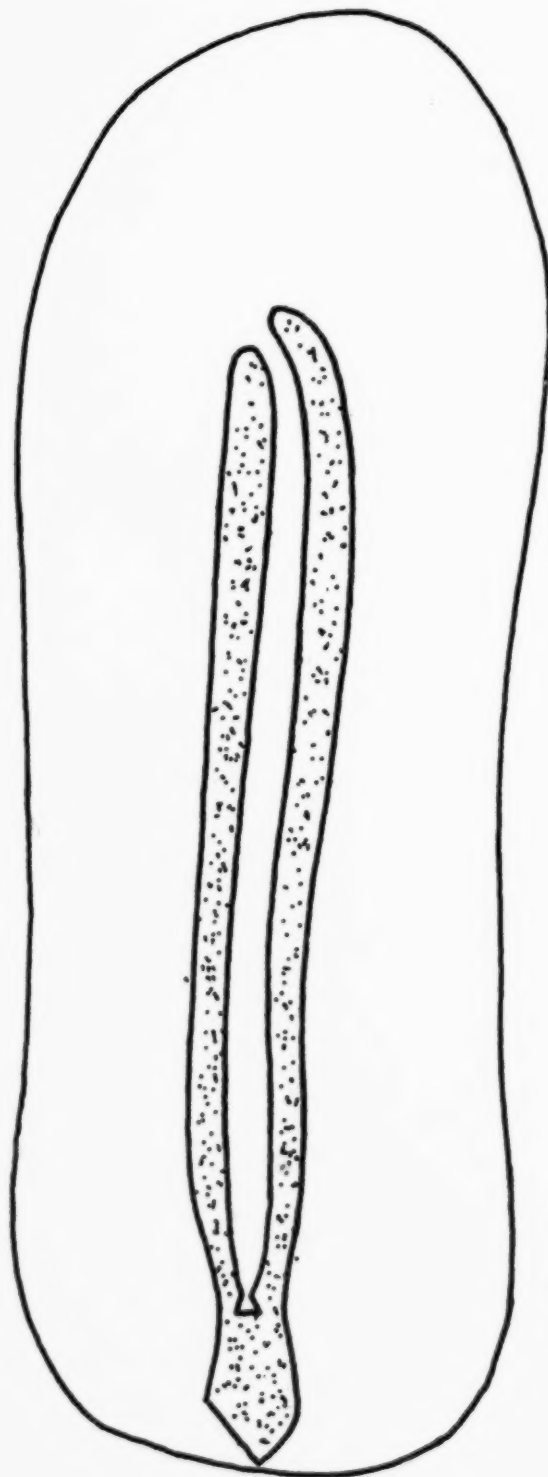
MONOCOT SEED



(L.S.)



DICOT SEED



(L.S.)





—— SEED COAT

—— ENDOSPERM

—— COTYLEDONS

—— PLUMULE

—— HYPOCOTYL

—— RADICLE



INFLORESCENCE TYPES





—— SPIKELET

—— BRACT

—— RACHIS

SPIKE

—— SPIKELET

—— PEDICLE

—— RACHIS

—— BRACT

RACEME

—— SPIKELET

—— CENTRAL AXIS

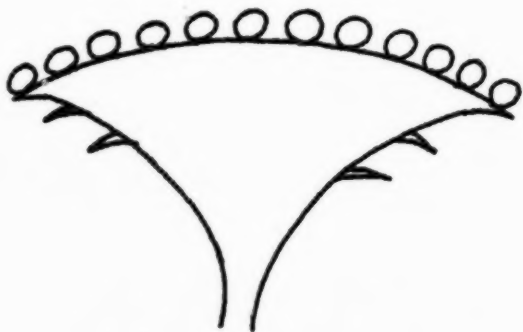
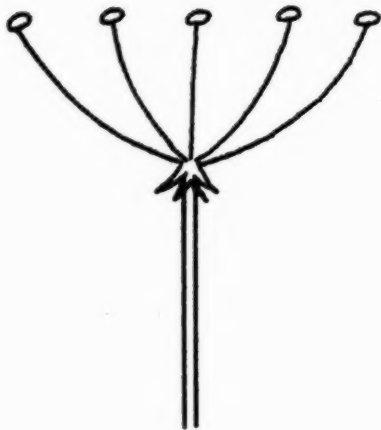
—— BRANCH

—— BRACT

—— PEDICLE



INFLORESCENCE TYPES





—— PEDICLE

—— INVOLUCRE

—— PEDUNCLE

UMBLE

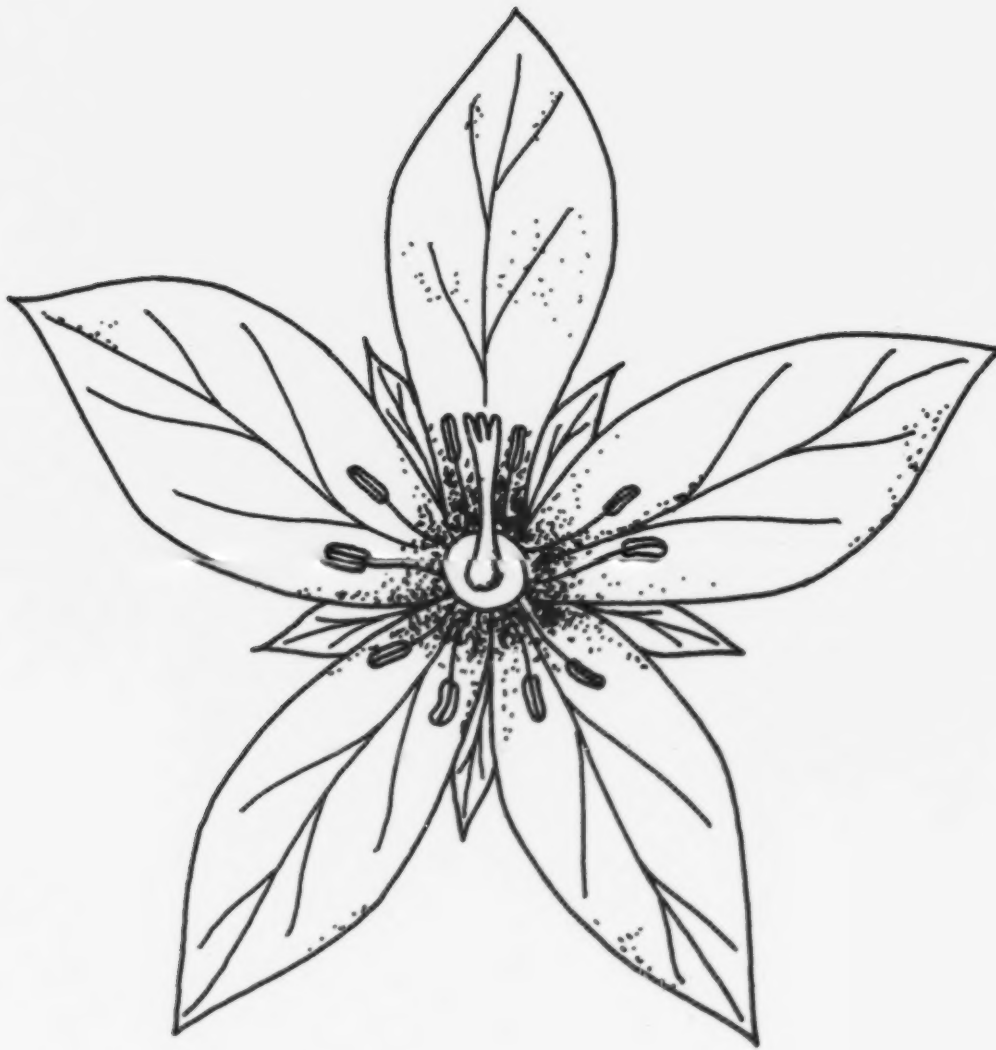
—— RECEPTACLE

—— INVOLUCRE

HEAD



TYPICAL DICOT FLOWER





_____ PETAL

_____ SEPAL

_____ PISTLE

_____ STAMEN



TYPICAL MONOCOT FLOWER





_____ PETAL

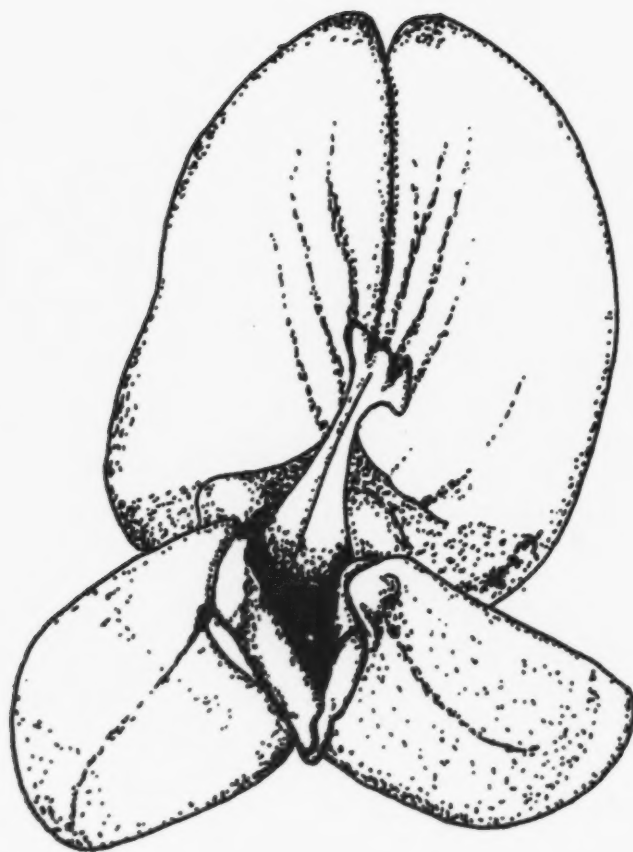
_____ SEPAL

_____ PISTLE

_____ STAMEN



LEGUME FLOWER





STANDARD
PETAL

SEXUAL
COLUMN

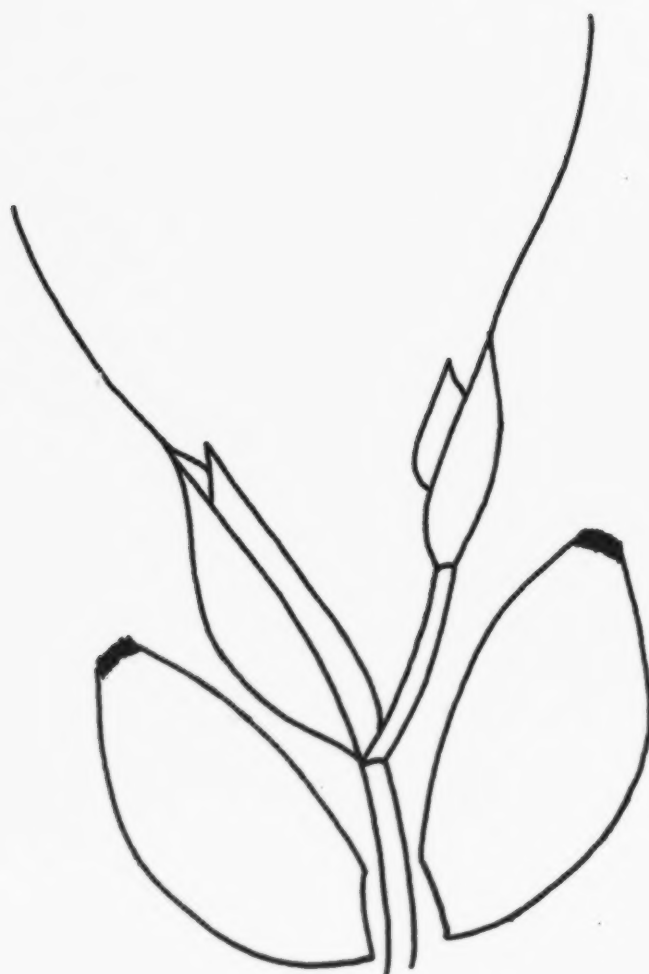
WING
PETAL

KEEL
PETAL



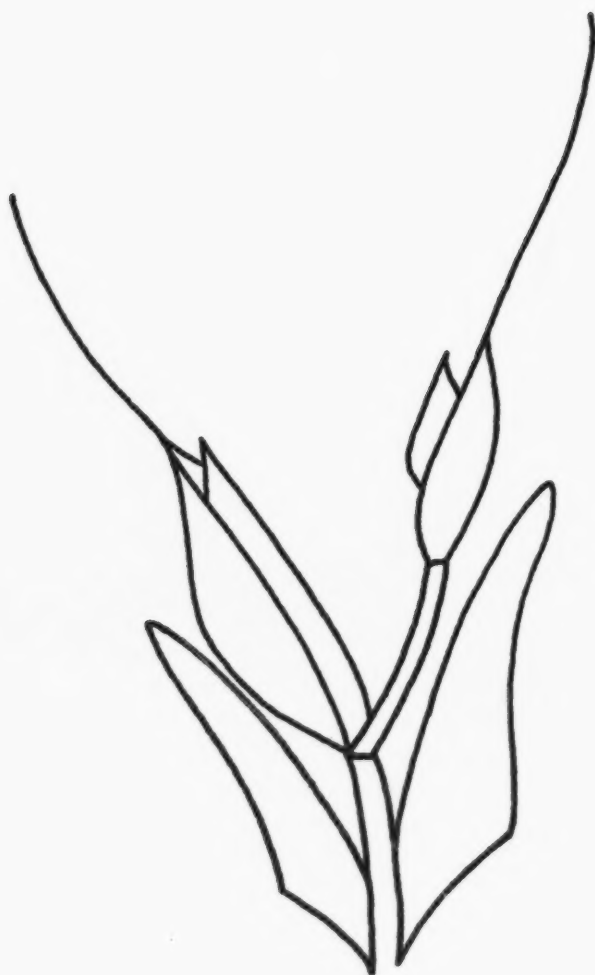


WHEAT SPIKELET



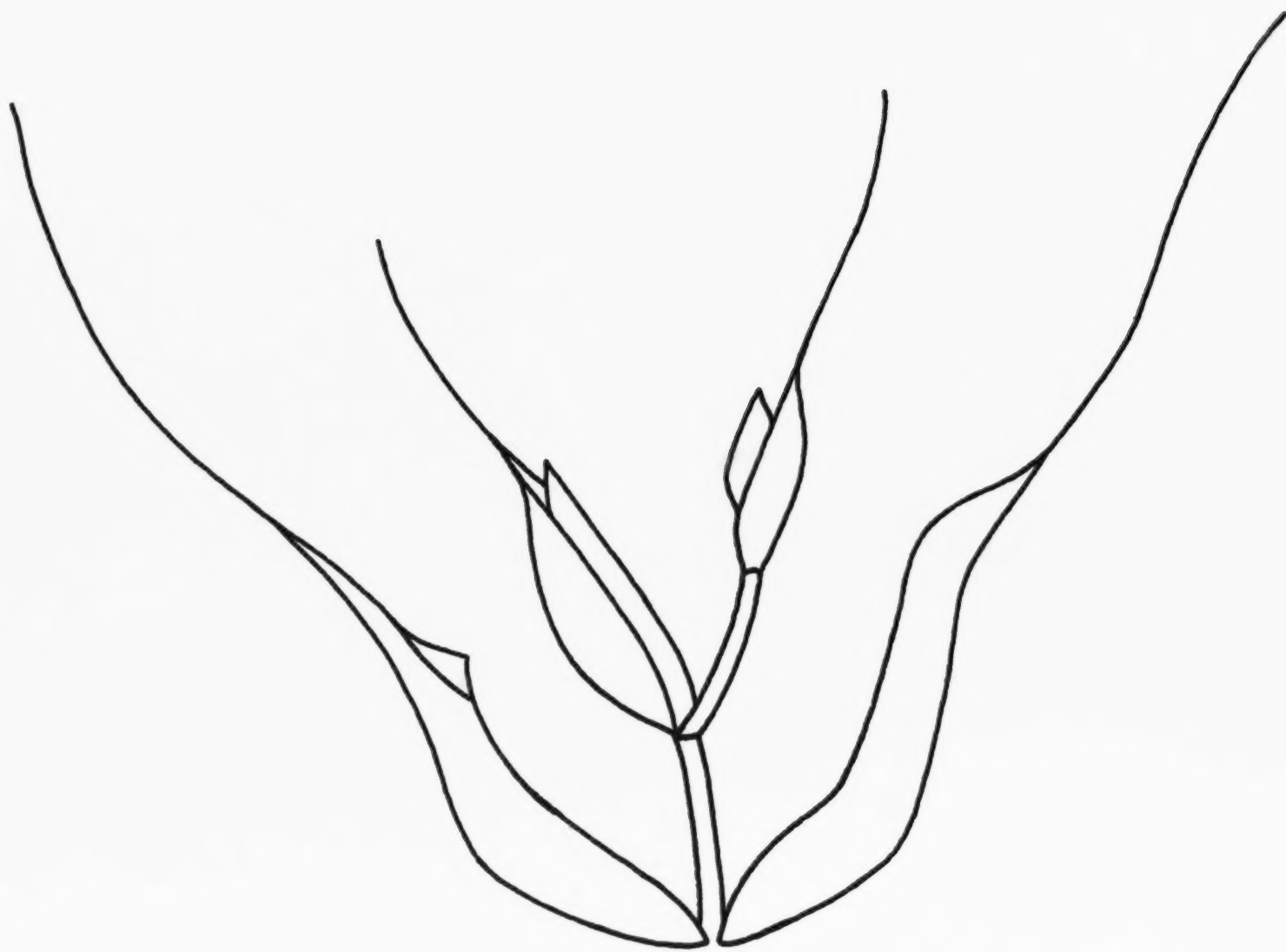
CARYOPSIS





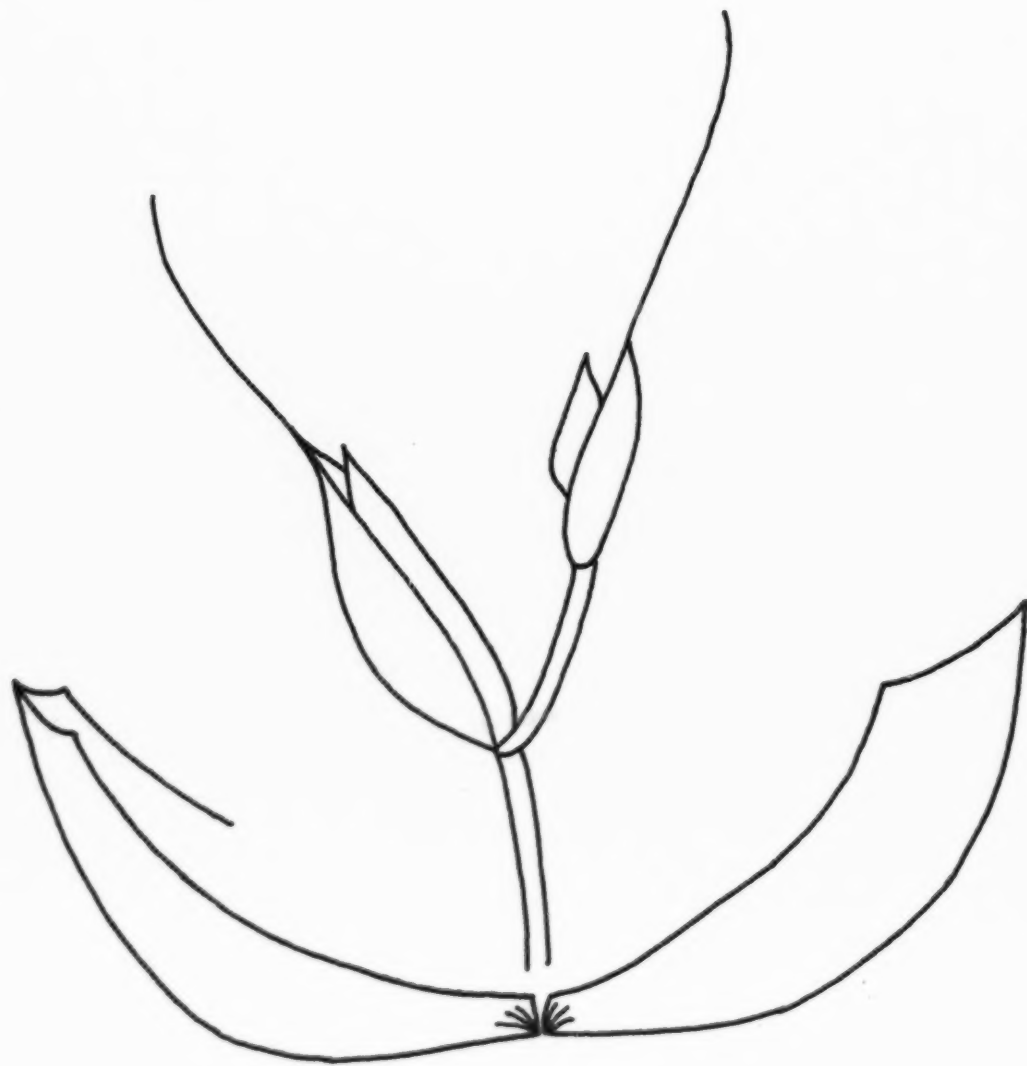
PALEA





LEMMA



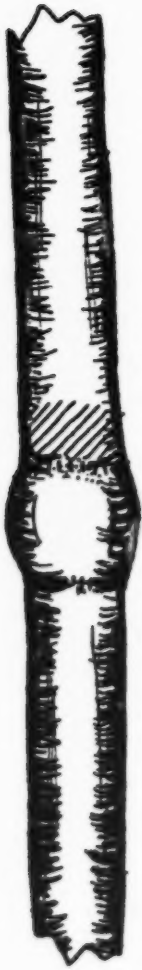


GLUME





MERISTEMATIC REGIONS



GRASS STEM



ALFALFA STEM





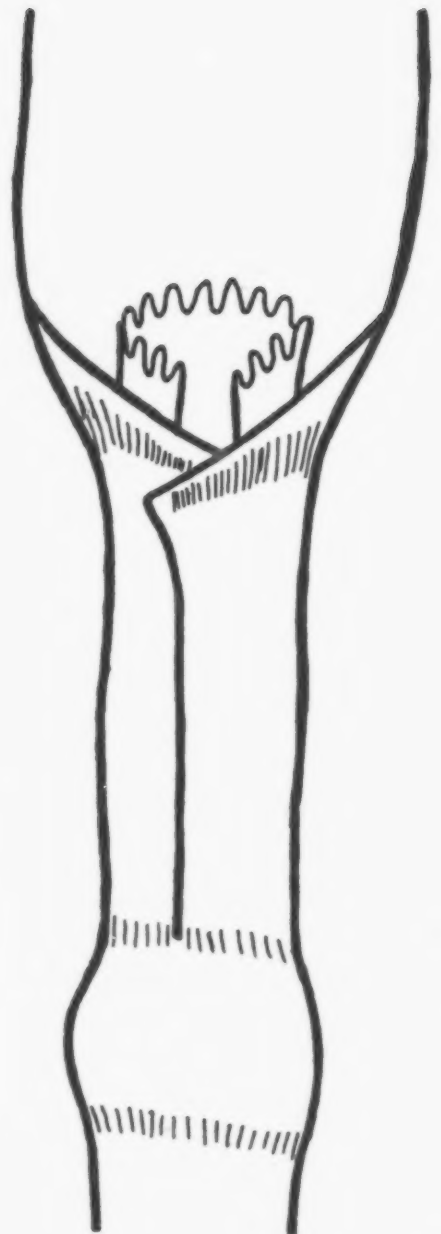
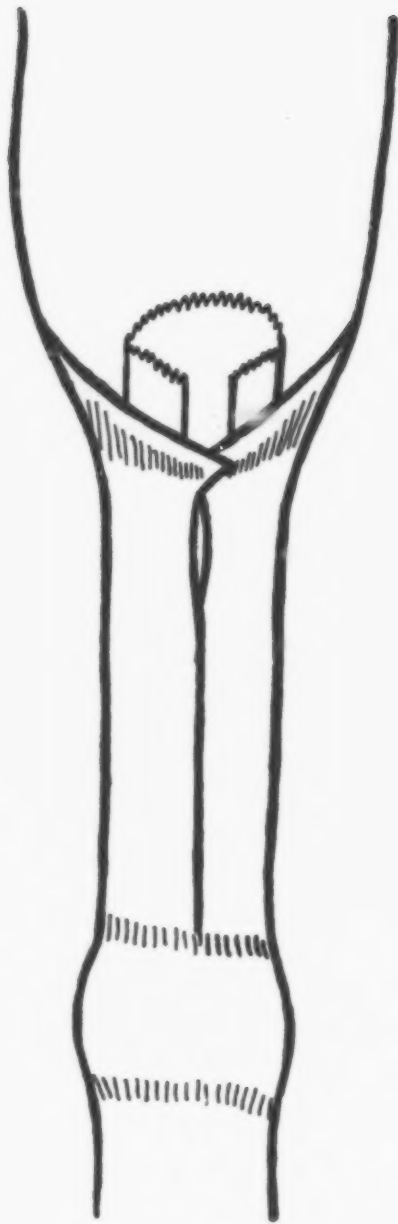
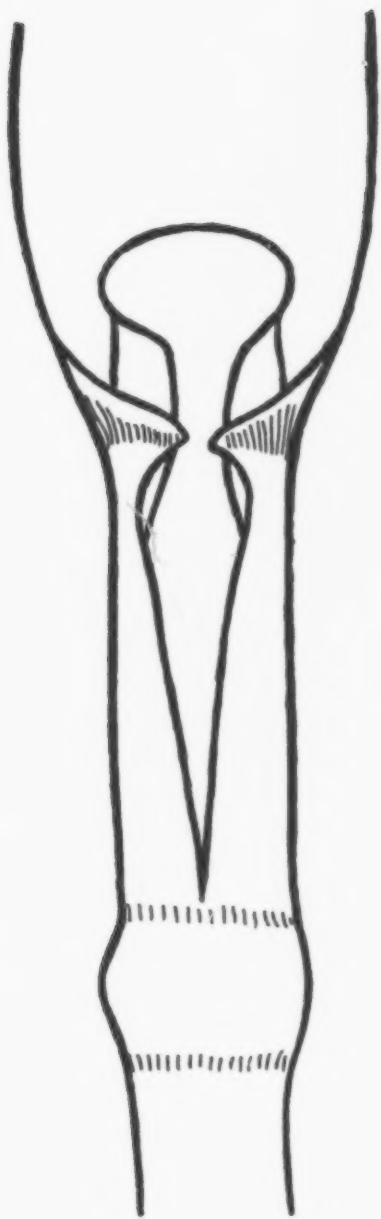
— APICAL
MERISTEM

— INTERCALARY
MERISTEM





COMMON SHEATH AND LIGULE TYPES





SMOOTH
LIGULE



SERRATED
LIGULE



LOBED
LIGULE



OPEN
SHEATH



CLOSED
SHEATH

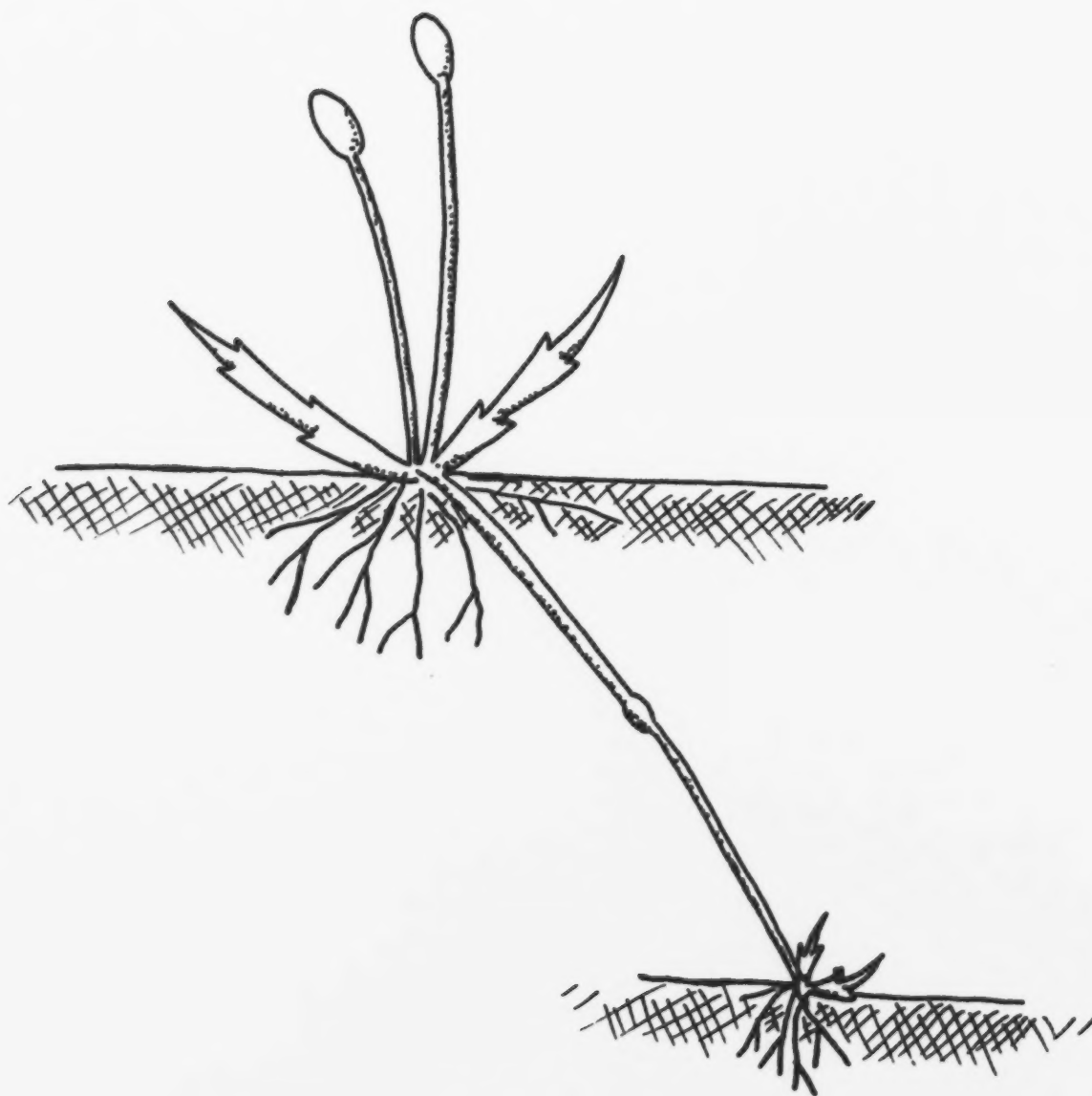


OVERLAPPED
SHEATH





STOLON: A SPECIALIZED STEM





—— STOLON

—— NODE

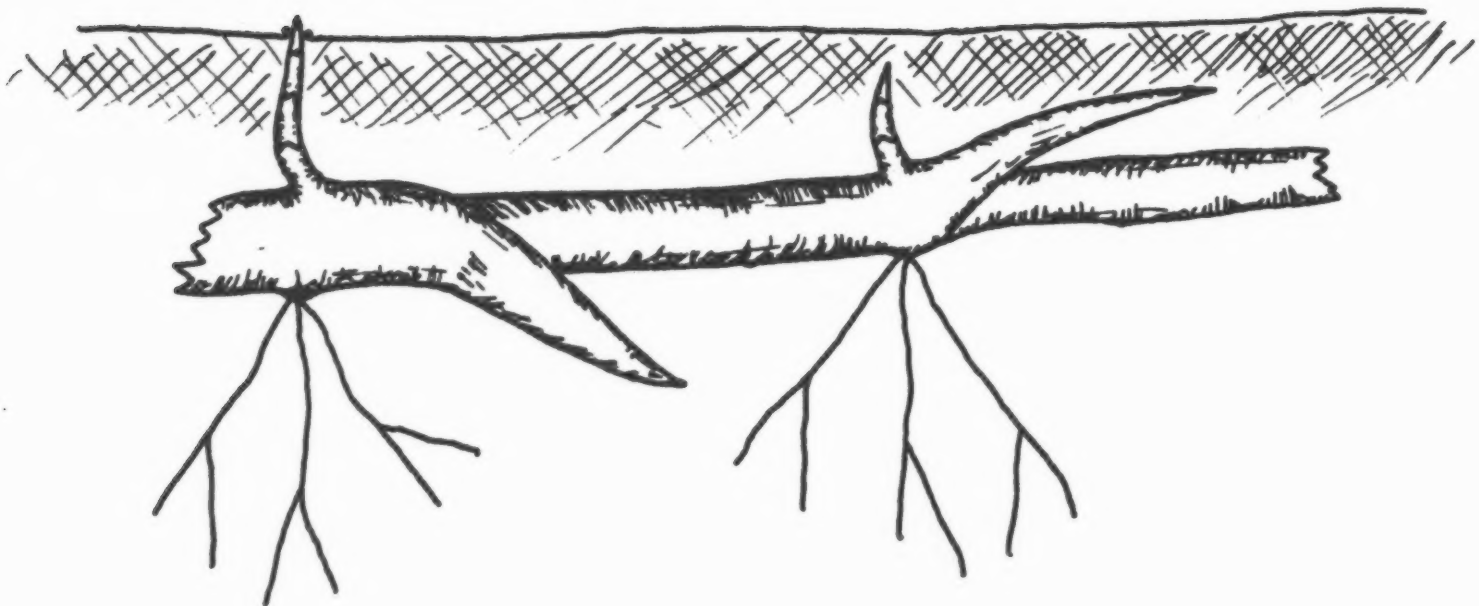


ADVENTITIOUS ROOTS





RHIZOME: AN UNDERGROUND STEM





AXILLARY
BUD

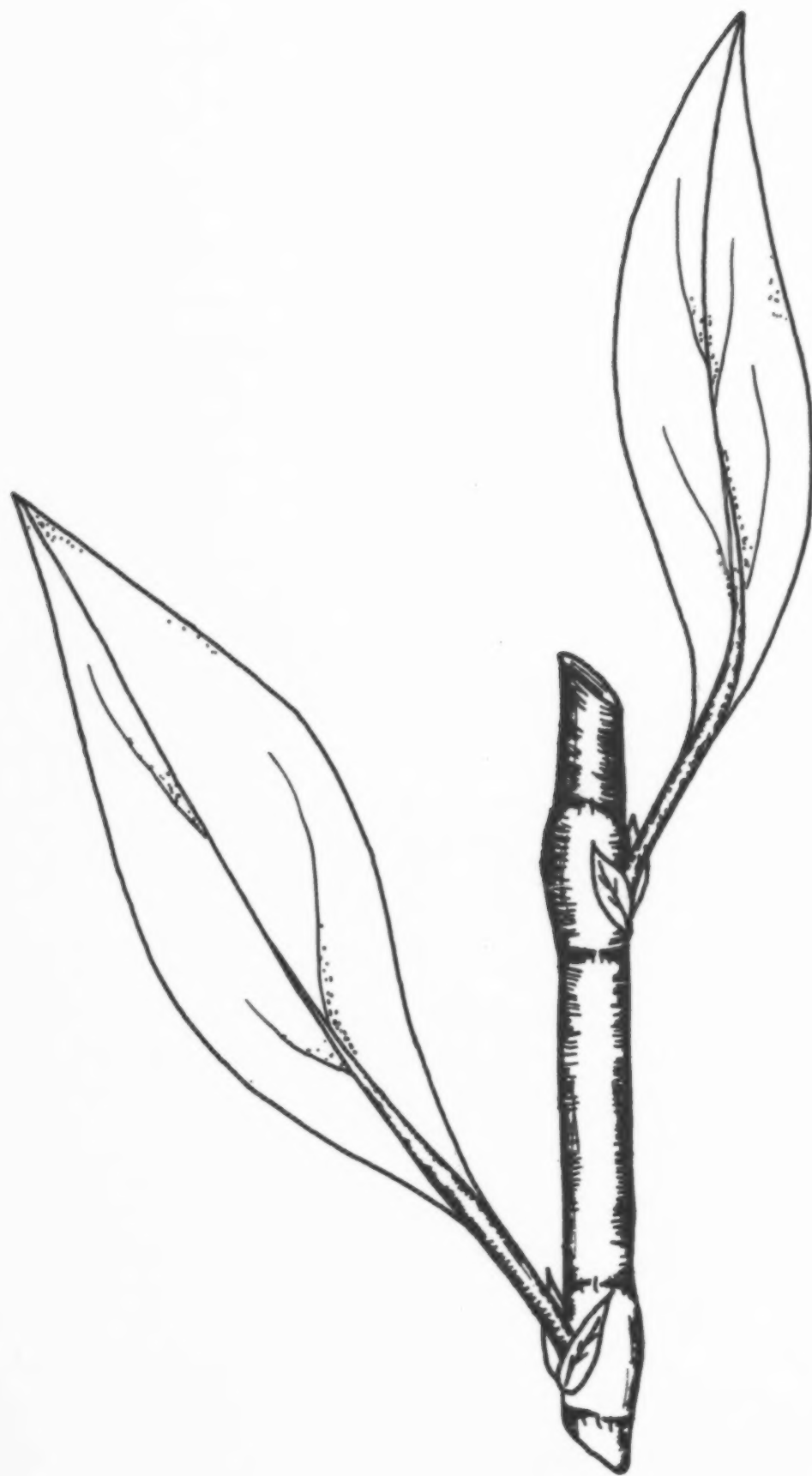
SCALE
LEAF

NODE

ADVENTITIOUS
ROOTS



SIMPLE BROAD LEAF





—— BLADE

—— PETIOLE

—— STIPULE

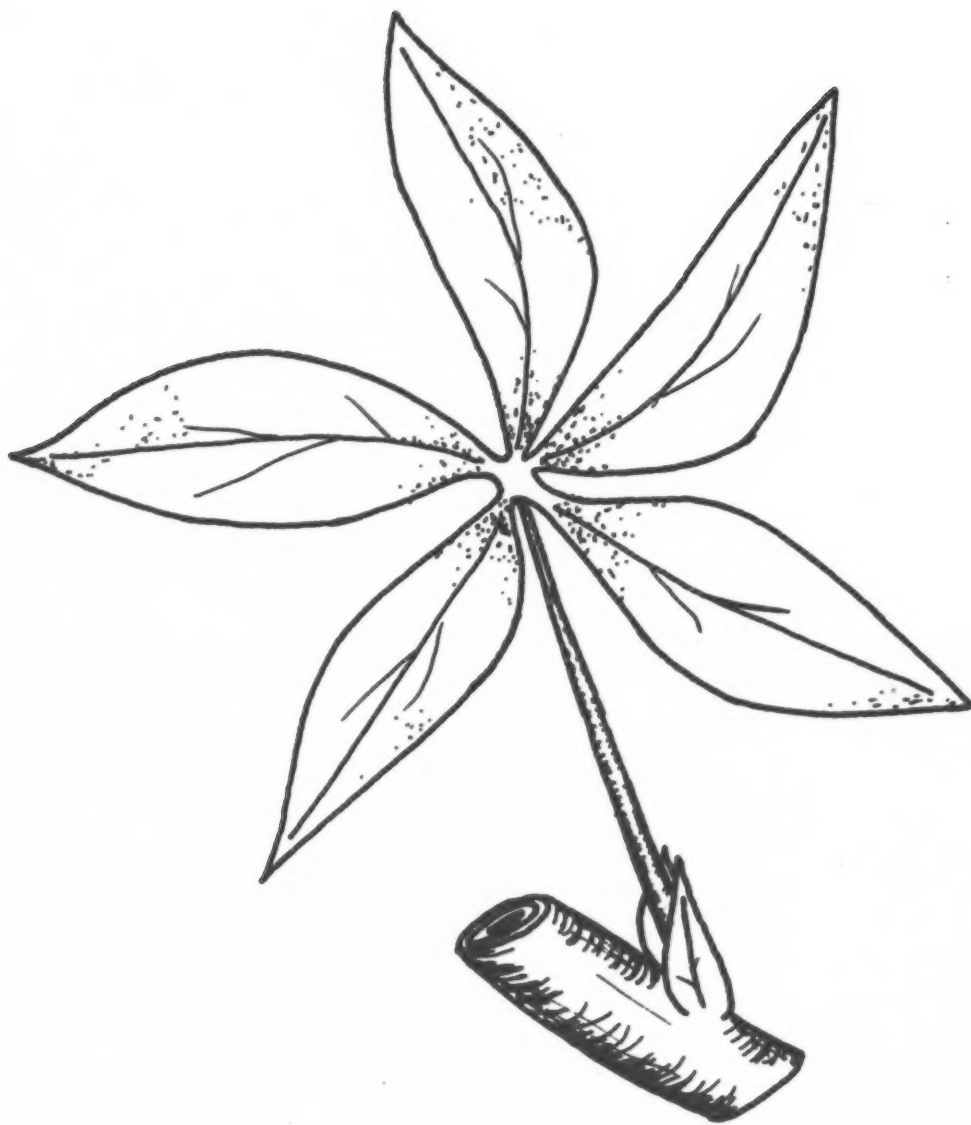
} ——— INTERNODE

—— NODE





SIMPLE PALMATELY COMPOUND LEAF





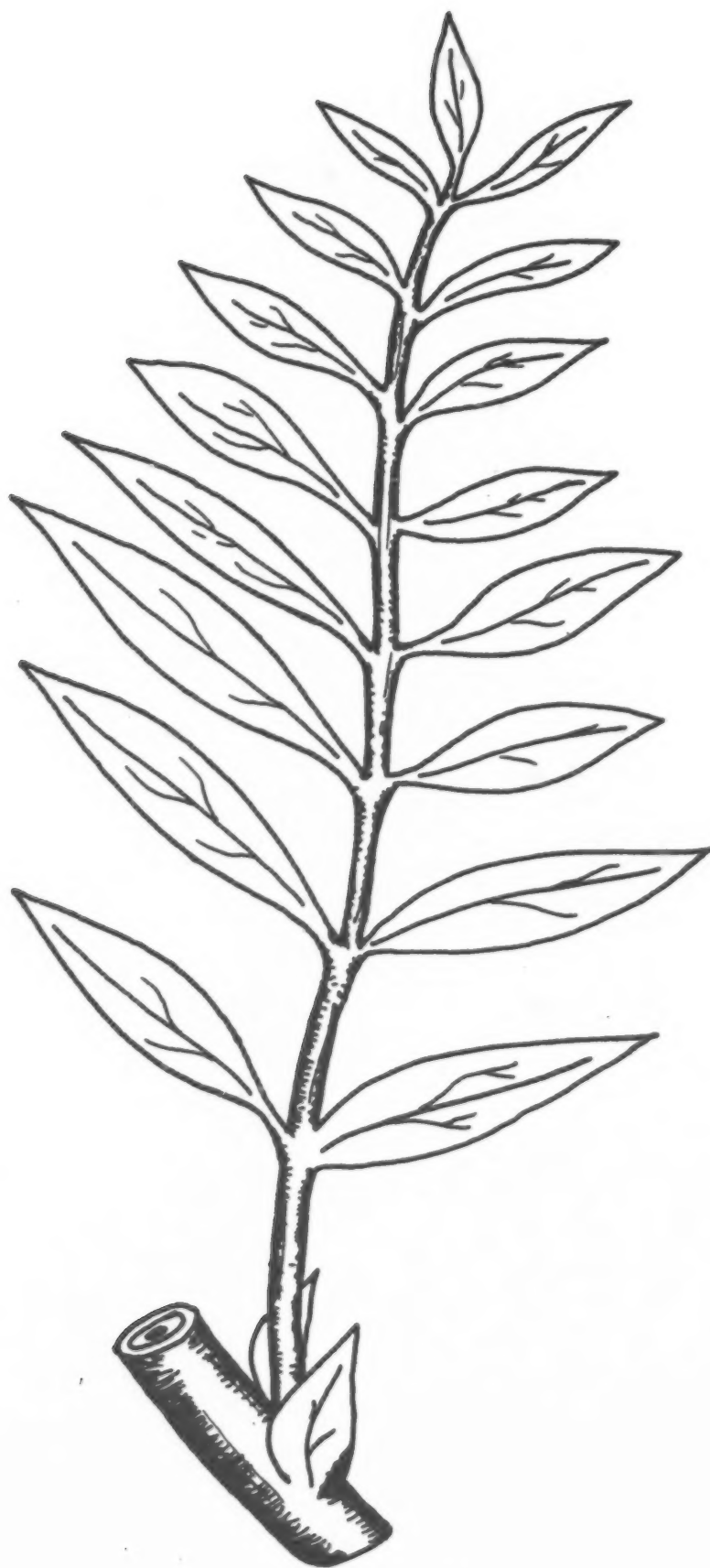
———— LEAFLET

———— PETIOLE

———— STIPULE



SIMPLE PINNATELY COMPOUND LEAF





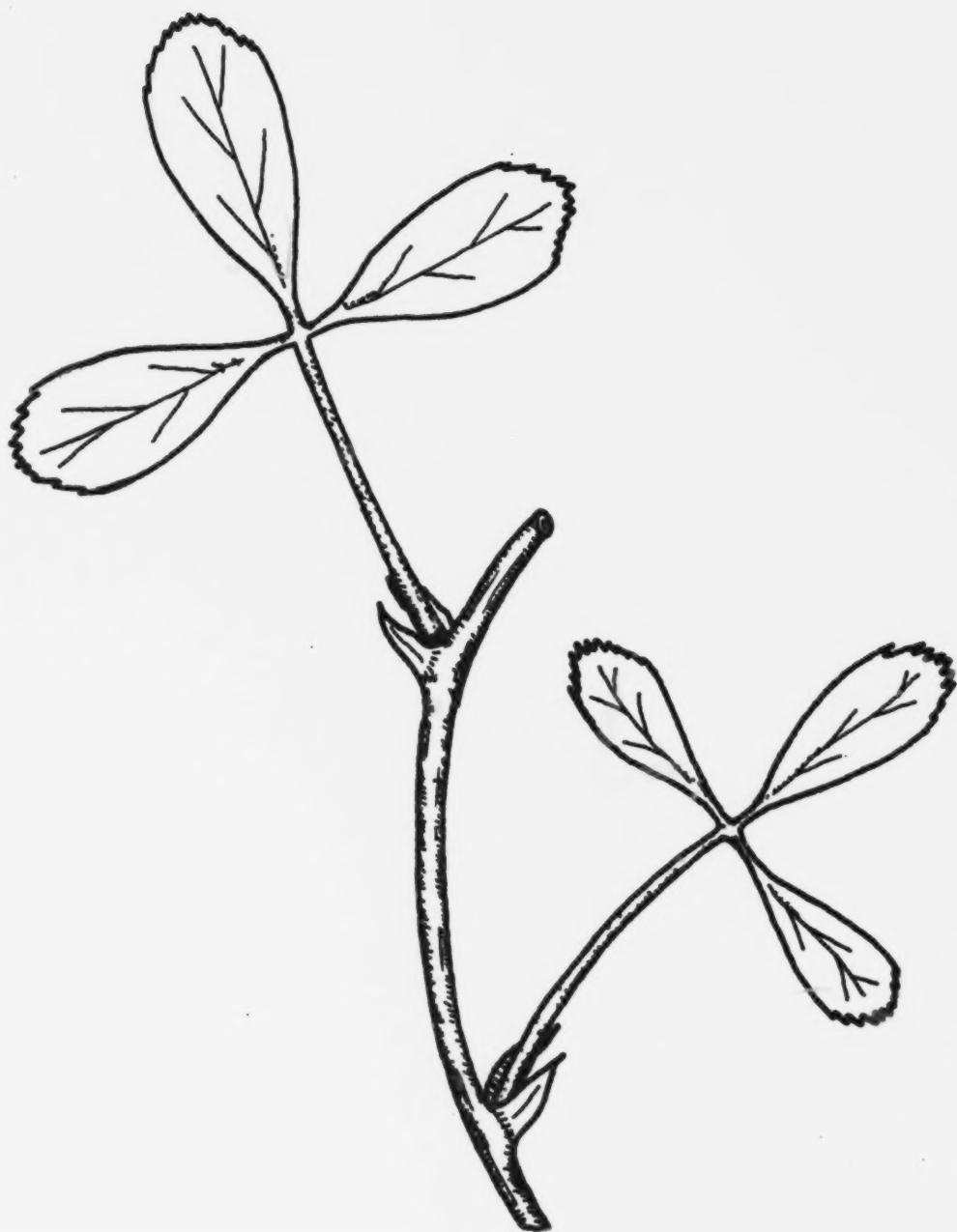
 **LEAFLETS**

 **PETIOLE**

 **STIPULE**



TYPICAL TRIFOLIOLATE LEGUME LEAF





_____ LEAFLET

_____ PETIOLE

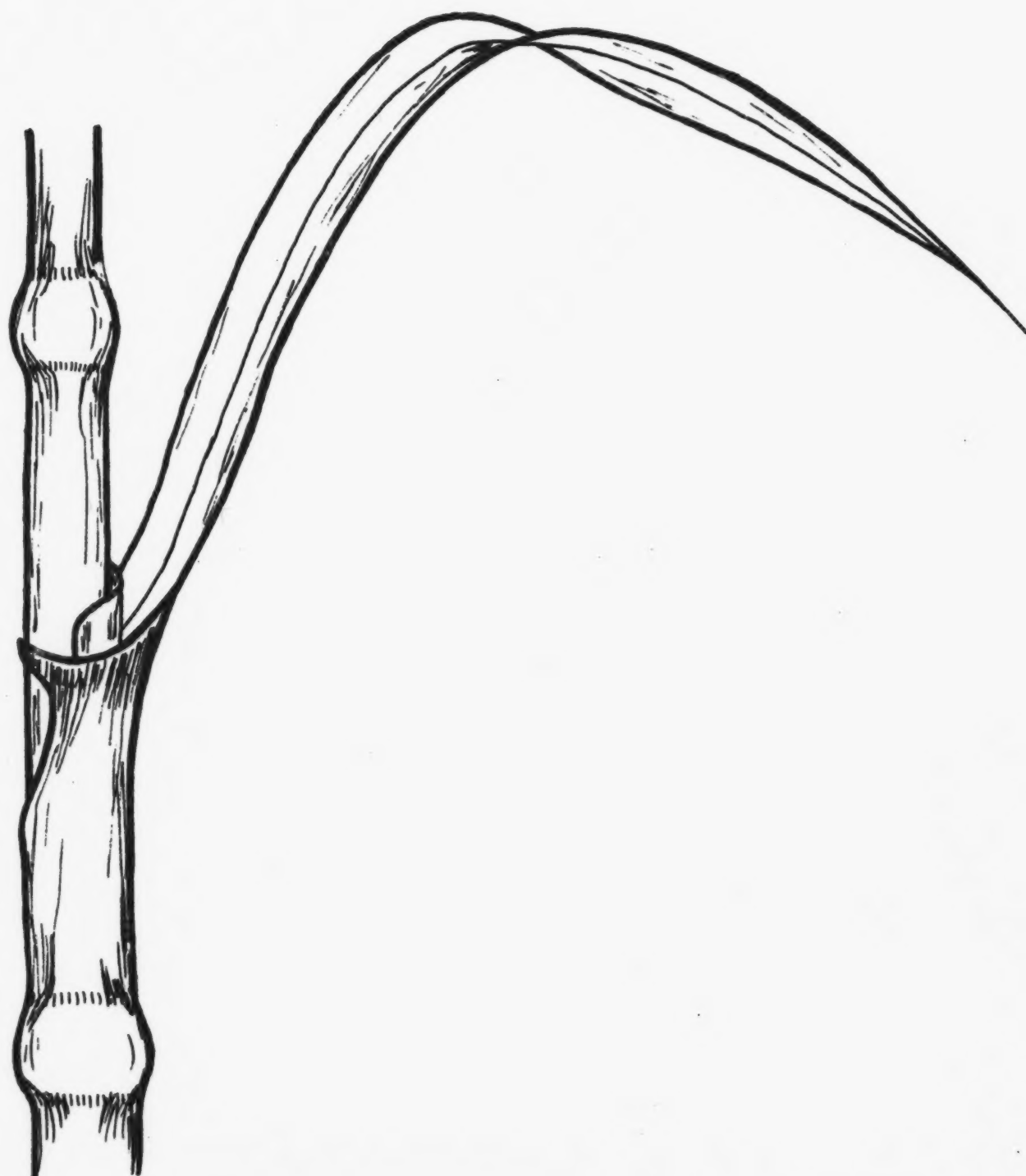
_____ PETIOLAR
BRANCH

_____ STIPULE





NARROW GRASS LEAF





——BLADE

——MIDRIB

——LIGULE

——COLLAR

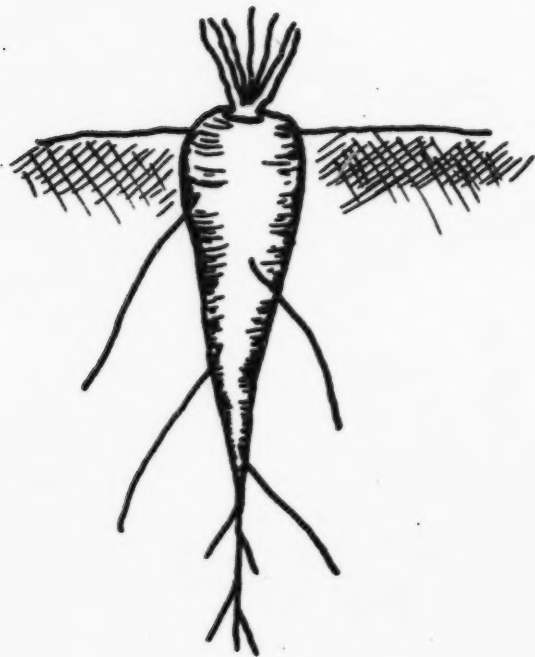
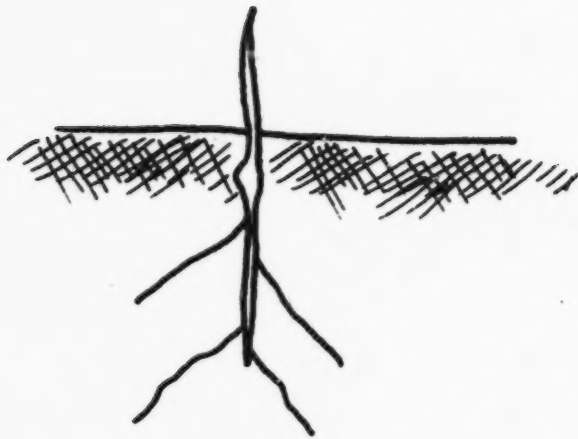
——AURICLE

——SHEATH

——NODE



TAP ROOT SYSTEM





— RADICLE

— PRIMARY
ROOT

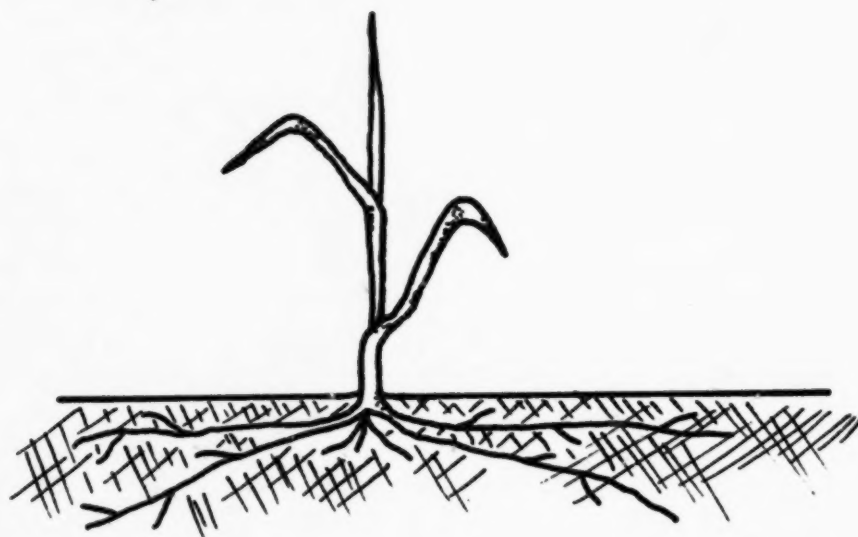
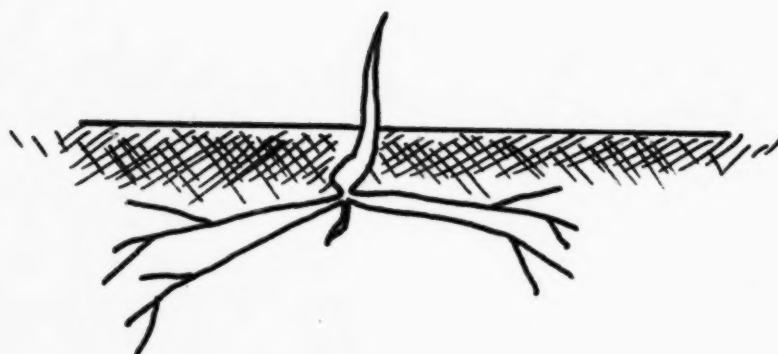
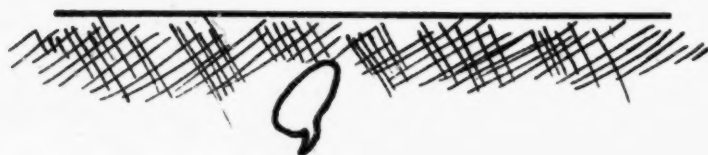
— SECONDARY
ROOTS

DEEP, PENETRATING
ROOT SYSTEM





FIBROUS ROOT SYSTEM





—— RADICLE

—— PRIMARY
ROOT

—— SECONDARY
ROOTS

SHALLOW, SPREADING
ROOT SYSTEM



CEREAL CROPS

SECTION II

TRANSPARENCY MASTERS FOR CROP AND WEED IDENTIFICATION

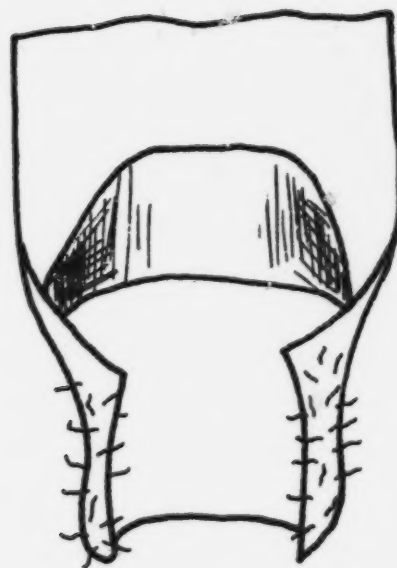
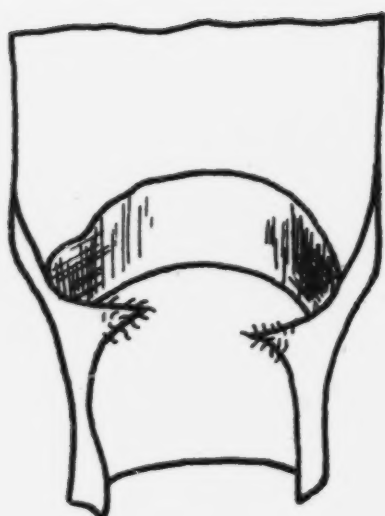
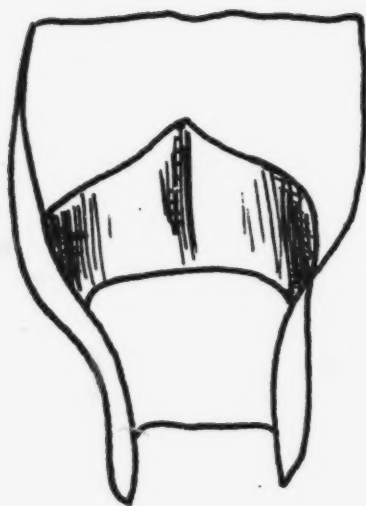
Dwane G. Miller Gilbert A. Long Clarence E. Manning

TABLE OF CONTENTS

SECTION II: CEREAL CROPS

Vegetative Characteristics of Cereals	61
Brush Lengths	63
Brush Sizes	65
Cheek Shapes	67
Crease Widths	69
Crease Depths	71
Kernel Shapes	73
Hard Red Winter Wheat	75
Hard Red Spring Sheat	77
Soft Red Winter Wheat	79
White Club Wheat	81
Amber Durum Wheat	83
Red Durum Wheat	85
Oat Seed	87
Barley	89
Rye	91

VEGETATIVE CHARACTERISTICS OF CEREALS



OATS
AURICLE LACKING
PUBESCENCE
LACKING

BARLEY
LONG AURICLE
PUBESCENCE
ON COLLAR

CORN
AURICLE LACKING
LIGULE MINUTE

WHEAT
MEDIUM AURICLE
PUBESCENCE ON
AURICLE

RYE
SHORT AURICLE
PUBESCENCE ON
COLLAR



BRUSH LENGTHS





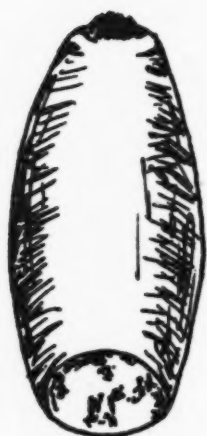
SHORT

MIDLONG

LONG



BRUSH SIZES





SMALL

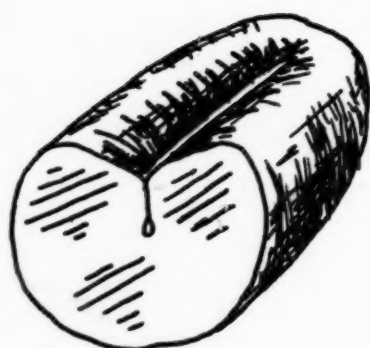
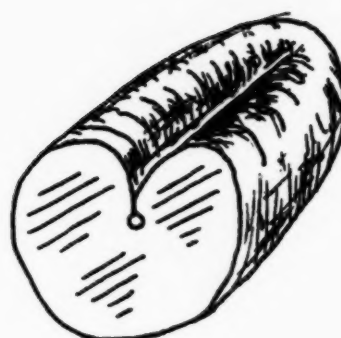
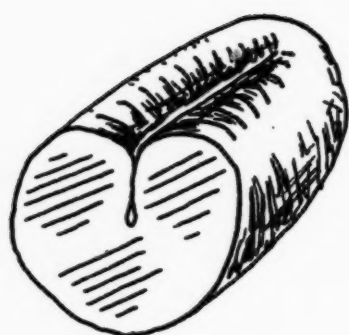
MIDSIZE

LARGE

COLLARED



CHEEK SHAPES





ROUNDED

ANGULAR



CREASE WIDTHS





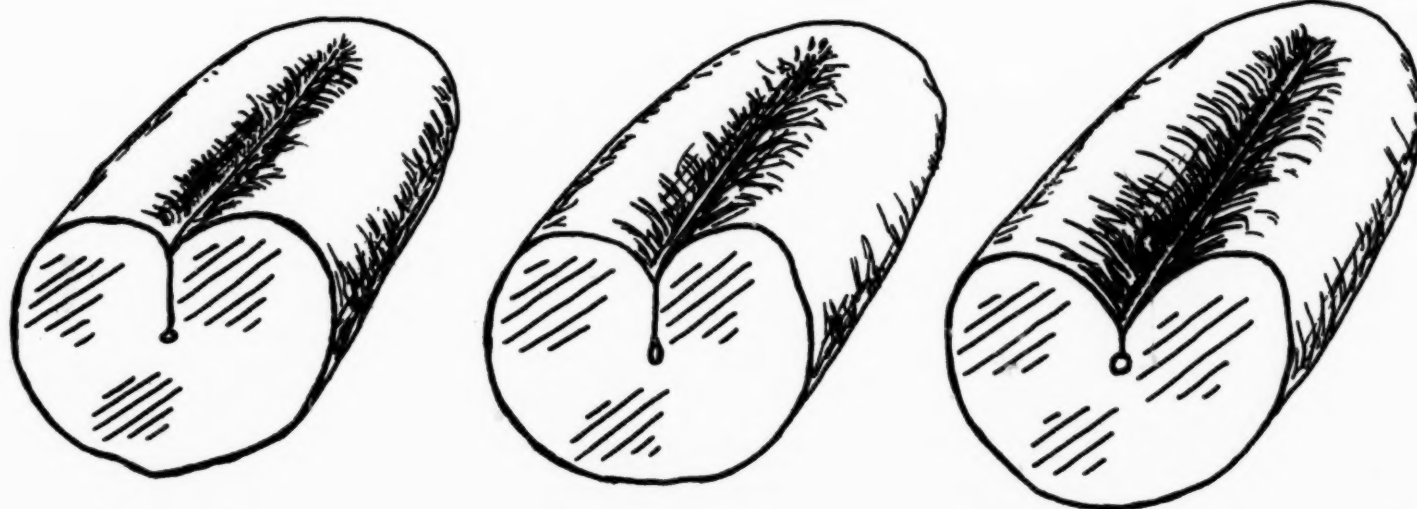
NARROW

MIDWIDE

WIDE



CREASE DEPTHS





SHALLOW

MIDDEEP

DEEP



KERNEL SHAPES





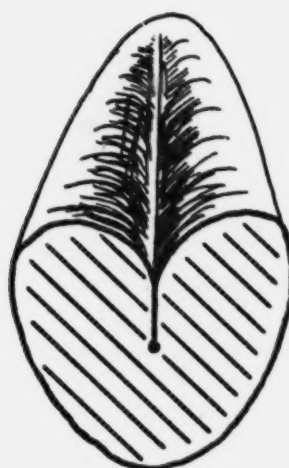
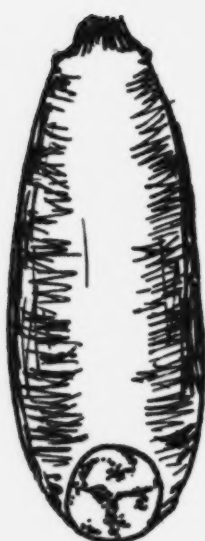
OVAL

ELLIPTICAL

OVATE



HARD RED WINTER WHEAT





**BRUSH
MIDLONG**

**LONG, SLENDER
KERNEL**

**ROUNDED
CREASE**

**SMALL
GERM**

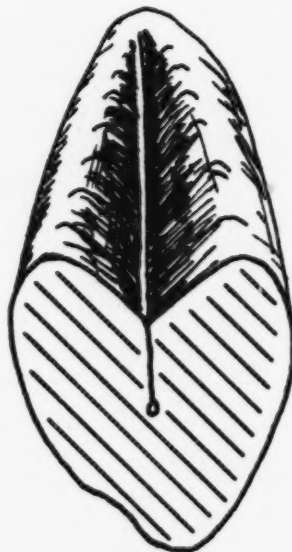
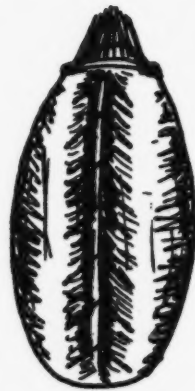
**WIDEST NEAR
GERM END**

**ROUNDED
CHEEKS**

**SMOOTH
BACK**



HARD RED SPRING WHEAT





**LONG, POINTED
BRUSH WITH A
DEFINATE RING**

**SHORT, PLUMP
KERNEL**

**LARGE
GERM**

**MIDDEEP
CREASE**

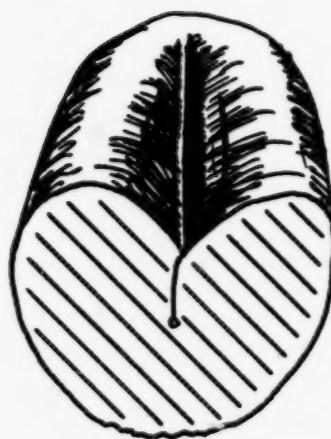
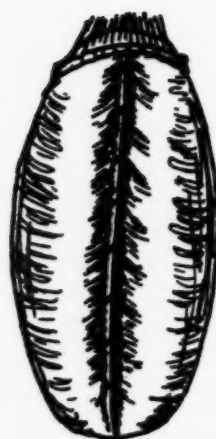
**ANGULAR
CHEEKS**

**BACK RIDGE
OFFSET WITH
DIMPLE**





SOFT RED WINTER WHEAT





BRUSH MIDLONG
DEFINATE RING

BARREL
SHAPED
KERNEL

OPEN
CREASE

LARGE
GERM

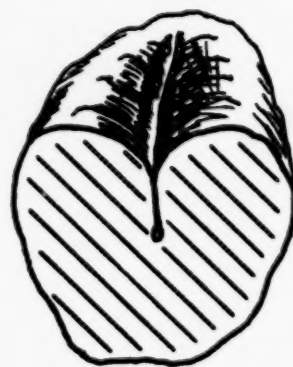
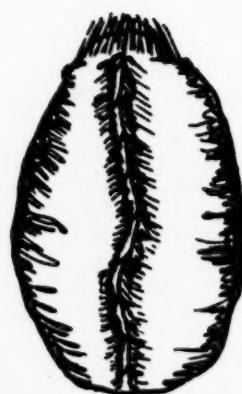
WIDEST
AT
MIDDLE

ROUNDED
CHEEKS

ROUND, SOMETIMES
WRINKLED BACK



WHITE CLUB WHEAT





BRUSH MIDLONG
SOMETIMES
POINTED

VERY IRREGULAR
SHAPED KERNEL

MIDDEEP
CREASE

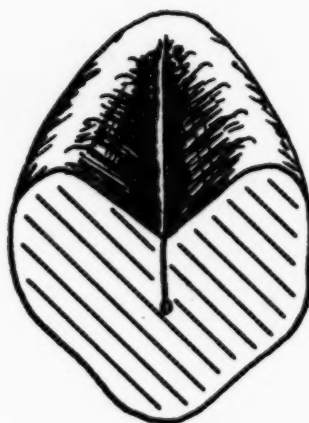
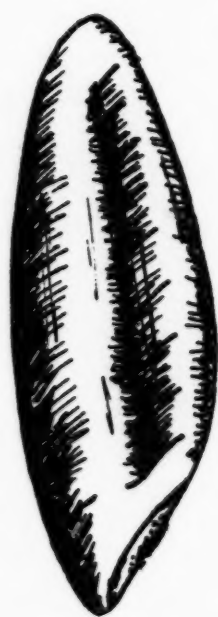
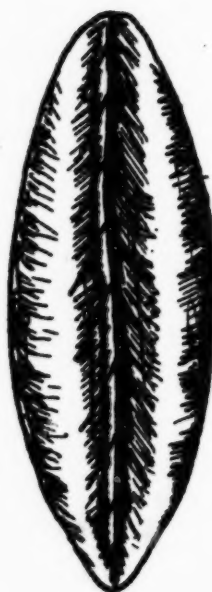
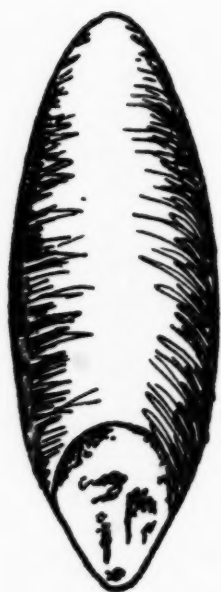
MIDSIZE
GERM

ROUNDED
CHEEKS

HUMP BACK
NEAR GERM



AMBER DURUM WHEAT





BRUSH VERY
SHORT OR
LACKING

LONG KERNEL

DEEP
CREASE

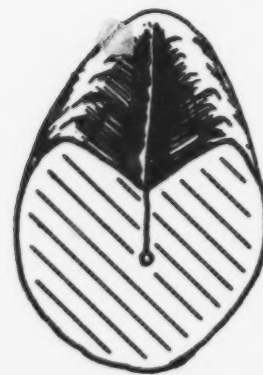
LONG POINTED
GERM

ANGULAR
CHEEKS

HIGH RIDGE
DOWN BACK



RED DURUM WHEAT





BRUSH
LACKING

WIDEST NEAR
TIP END

MIDDEEP
CREASE

SHARP
POINTED
GERM

ANGULAR
CHEEKS

ROUNDED
BACK



OAT SEED



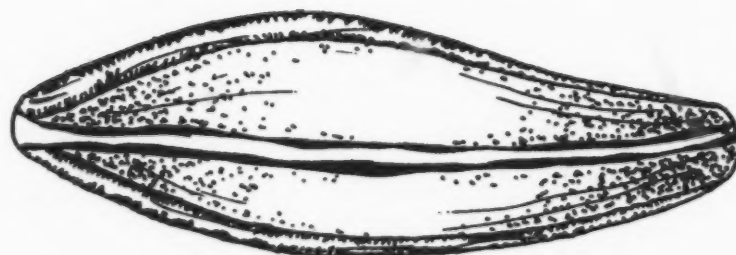
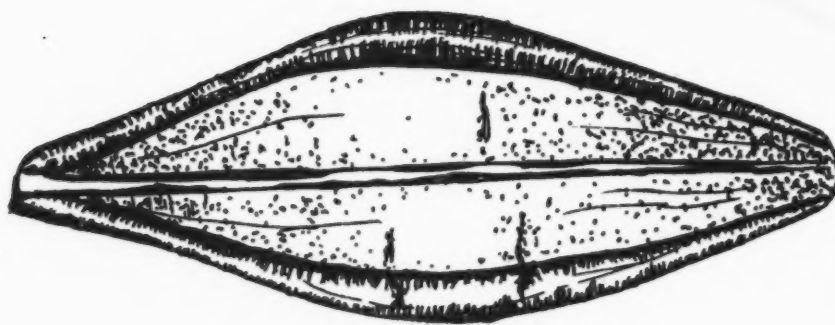


BRISTLES
ABCISSION
SEPARATION
TYPICAL
WILD OAT

BRISTLES
LACKING
FRACTURE
SEPARATION
TYPICAL
CULTIVATED OAT



BARLEY





2 - ROW

ALL KERNELS ARE STRAIGHT

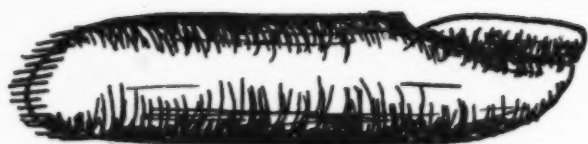
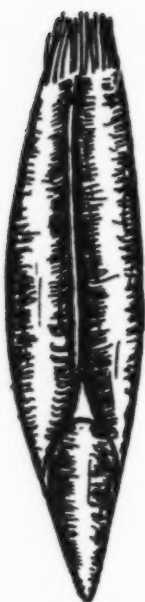
6 - ROW

**2/3 OF THE KERNELS ARE
BENT DUE TO CROWDING
AT RACHIS JOINT**





RYE





TETRA PETCUS

**DEEP, OPEN CREASE
LARGE, POINTED GERM
RIDGE ON BACK
SHORT BRUSH**

BALBOA

**SHALLOW, TIGHT CREASE
LARGE, POINTED GERM
SMOOTH BACK
SHORT BRUSH**



LEGUMES

SECTION III

TRANSPARENCY MASTERS FOR CROP AND WEED IDENTIFICATION

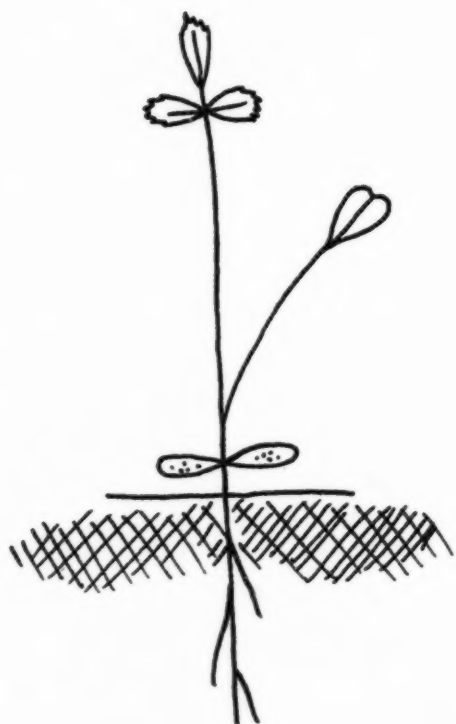
Dwane G. Miller Gilbert A. Long Clarence E. Manning

TABLE OF CONTENTS

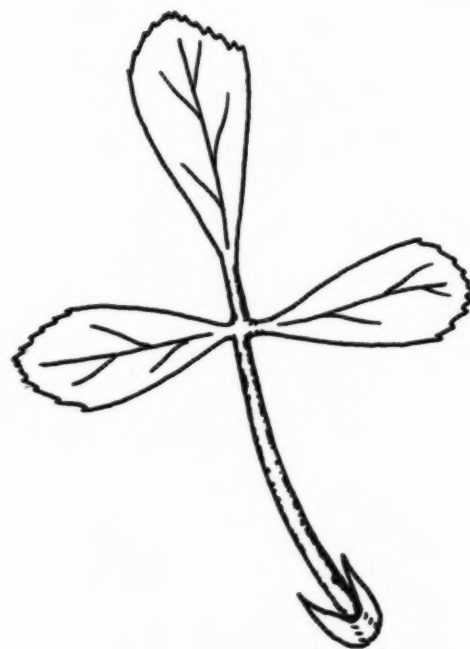
SECTION III: LEGUMES

Alfalfa	95
Sweetclover	96
Red Clover	97
White Clover	98
Alsike Clover	99
Strawberry Clover.	100
Subterranean Clover	101
Crimson Clover	102
Hairy Vetch	103
Birdsfoot Trefoil	104

ALFALFA

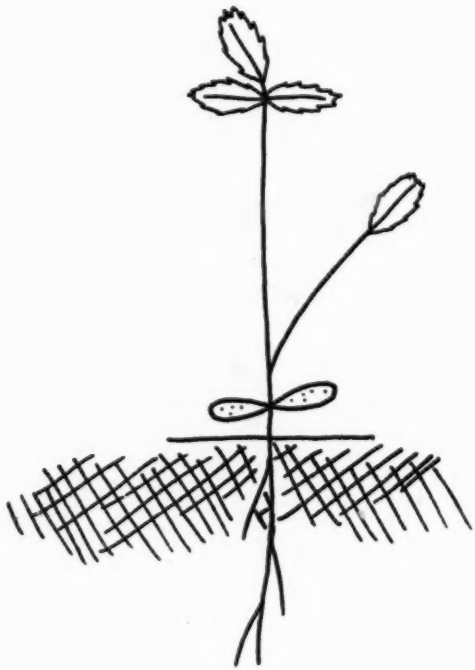


SEEDLING

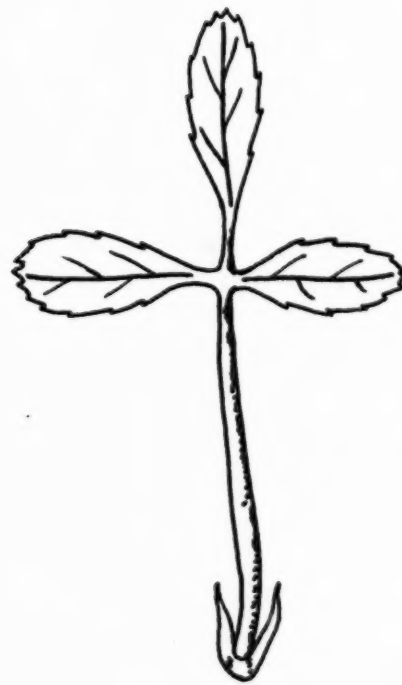


MATURE LEAF

SWEETCLOVER

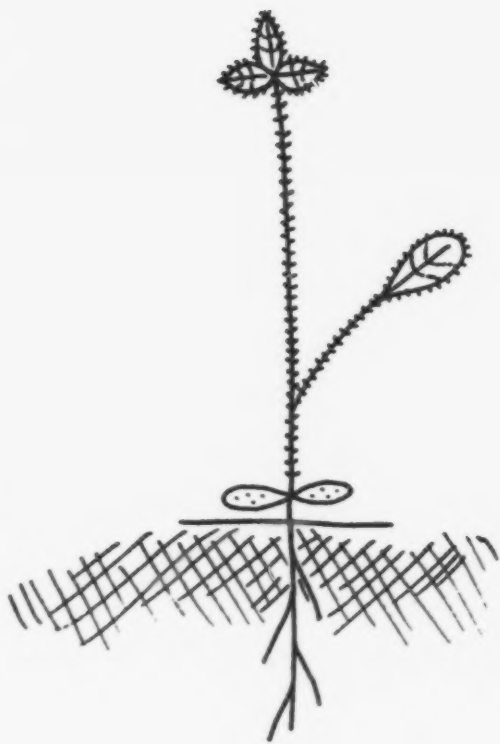


SEEDLING



MATURE LEAF

RED CLOVER

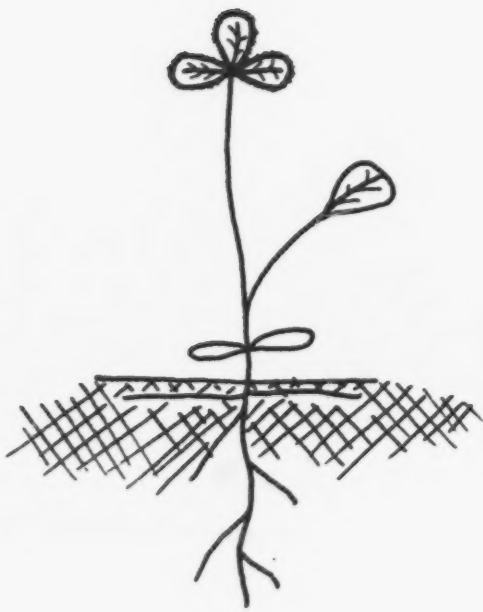


SEEDLING



MATURE LEAF

WHITE CLOVER

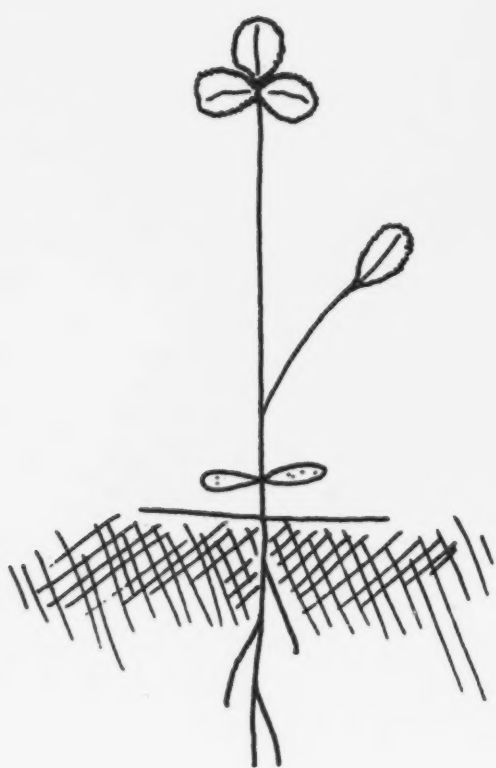


SEEDLING

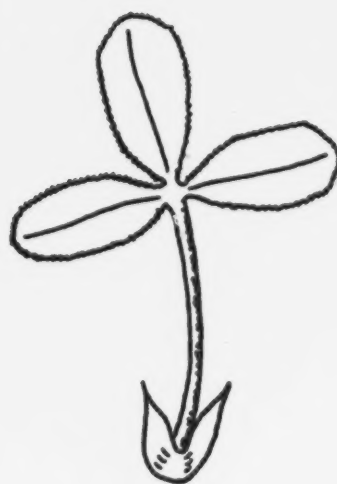


MATURE LEAF

ALSIKE CLOVER



SEEDLING



MATURE LEAF

STRAWBERRY CLOVER

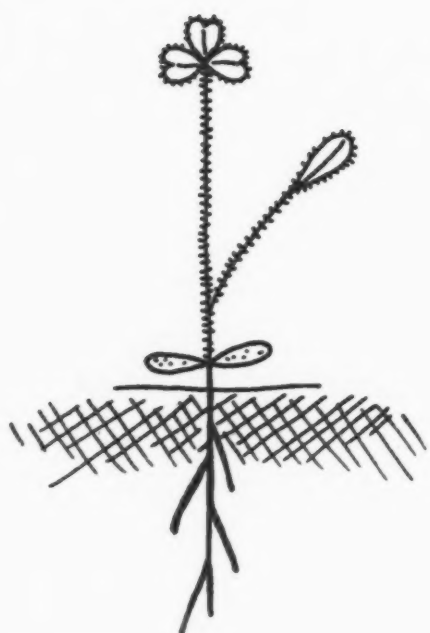


SEEDLING



MATURE LEAF

SUBTERRANEAN CLOVER

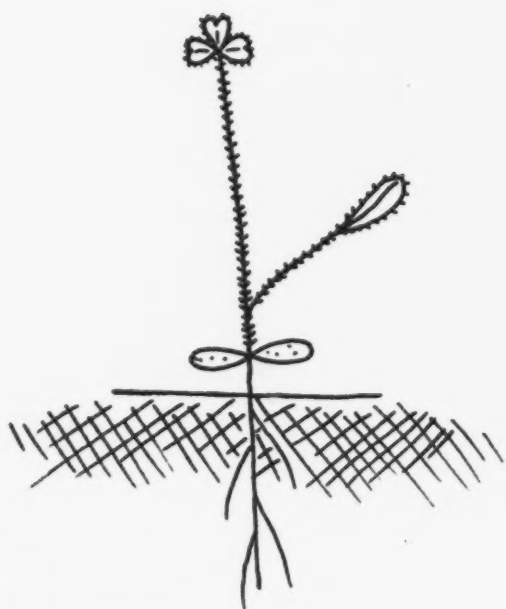


SEEDLING

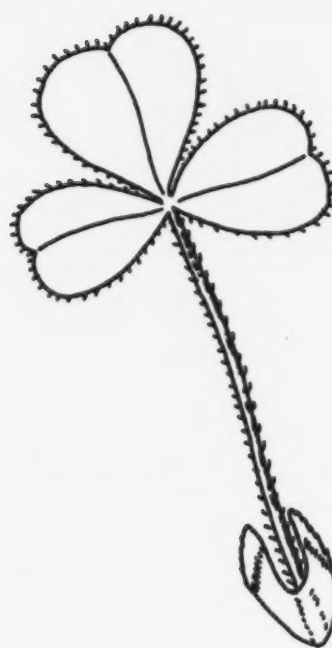


MATURE LEAF

CRIMSON CLOVER



SEEDLING

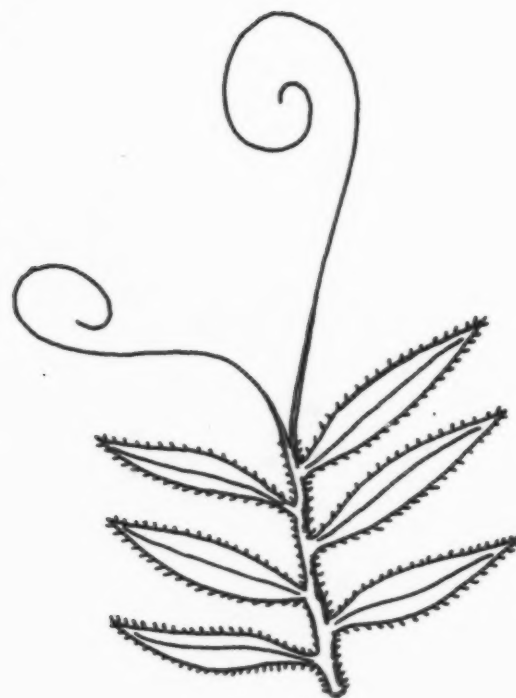


MATURE LEAF

HAIRY VETCH

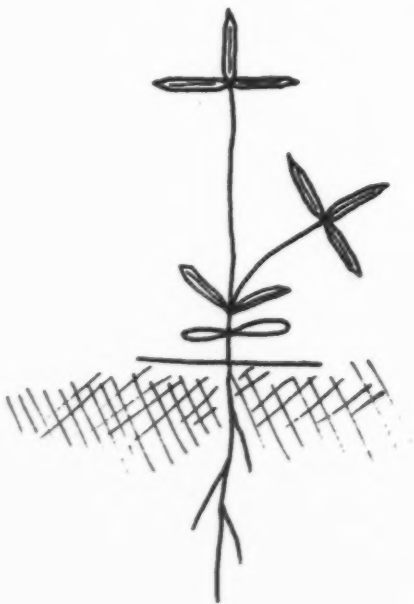


SEEDLING

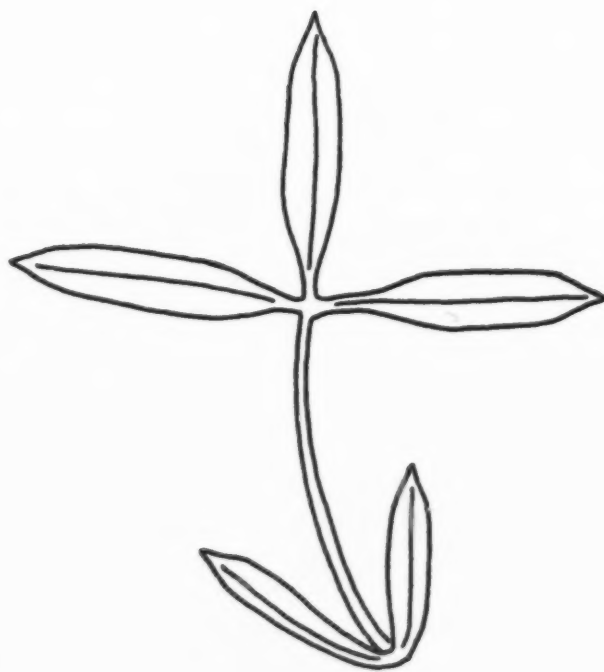


MATURE LEAF

BIRDSFOOT TREFOIL



SEEDLING



MATURE LEAF

GRASSES

SECTION IV

TRANSPARENCY MASTERS FOR CROP AND WEED IDENTIFICATION

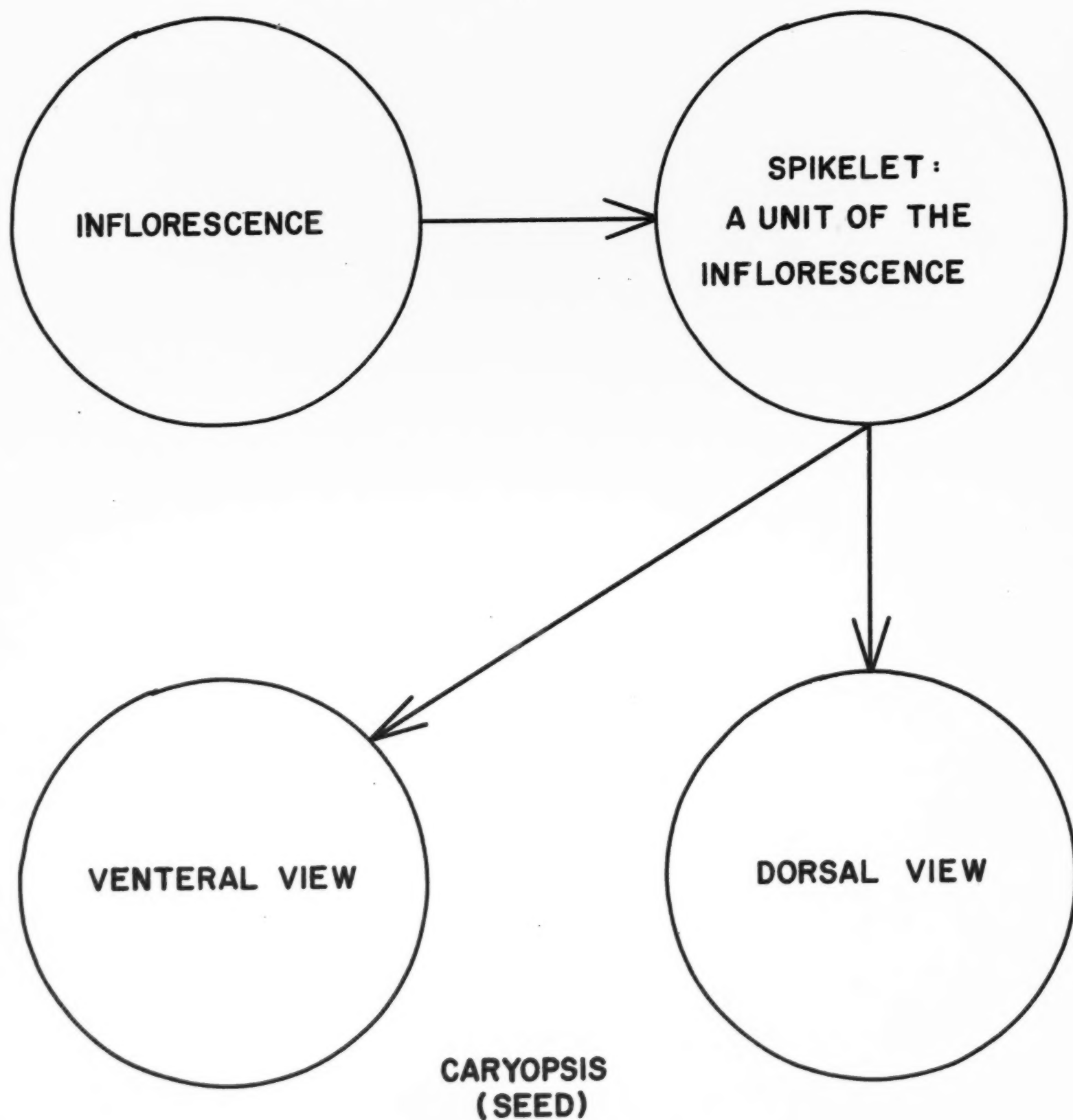
Dwane G. Miller Gilbert A. Long Clarence E. Manning

TABLE OF CONTENTS

SECTION IV: GRASSES

Prospective view of the various parts of the grass	
inflorescence showing levels of development	107
Kentucky Bluegrass	108
Big Bluegrass	110
Bulbous Bluegrass	112
Smooth Bromegrass	113
Mountain Bromegrass	115
Tall Fescue	117
Red Fescue	119
Orchardgrass	121
Intermediate Wheatgrass	123
Crested Wheatgrass	125
Perennial Ryegrass	127
Tall Oatgrass	129
Reed Canarygrass	131
Red Top	133
Timothy	135

**PROSPECTIVE VIEW OF THE VARIOUS PARTS OF THE GRASS
INFLORESCENCE SHOWING LEVELS OF DEVELOPMENT.**



KENTUCKY BLUEGRASS



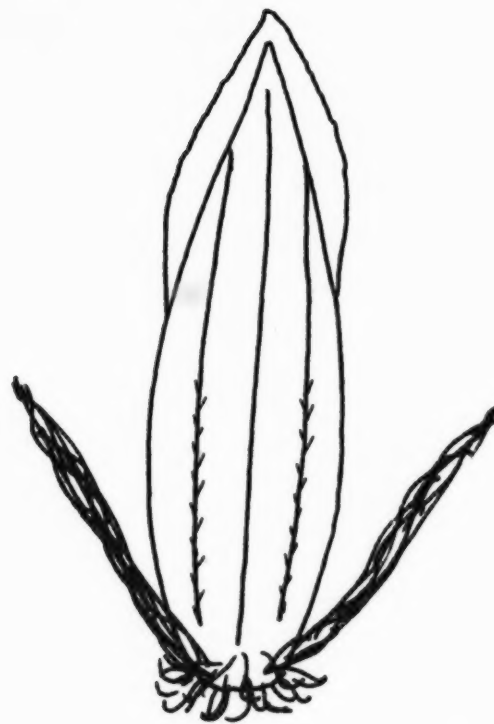
INFLORESCENCE



SPIKELET



SEED



FLORET

GLUMES

— PALEA

— LEMMA

— RACHILLA

— STERILE
FLORETS

BIG BLUEGRASS



INFLORESCENCE



SPIKELET



SEED

FLORET

GLUMES

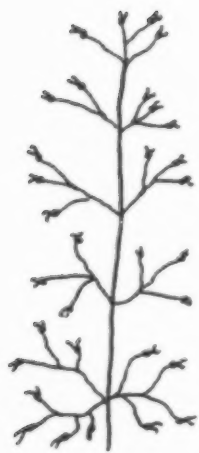
—— LEMMA

—— PALEA

—— RACHILLA



BULBOUS BLUEGRASS



INFLORESCENCE

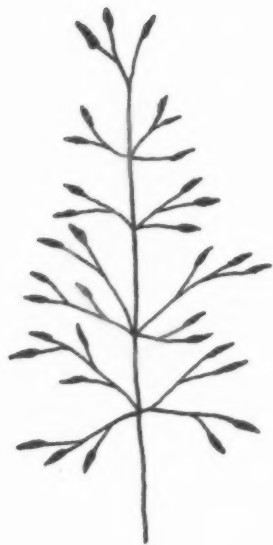


BULBLET



BULB

SMOOTH BROMEGRASS



INFLORESCENCE



SPIKELET



SEED



FLORET
GLUMES

— AWNLET

— PALEA

— LEMMA

— RACHILLA





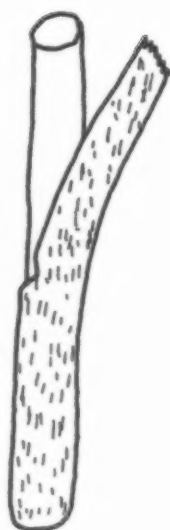
MOUNTAIN BROMEGRASS



INFLORESCENCE



SPIKELET



STEM



SEED
115





FLORET



GLUMES



PUBESCENT
LEAF AND
SHEATH

AWN

— LEMMA

— PALEA

— RACHILLA





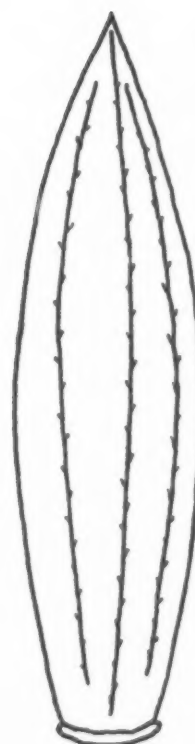
TALL FESCUE



INFLORESCENCE



SPIKELET



SEED





FLORET —

GLUMES <

—— PALEA

—— LEMMA

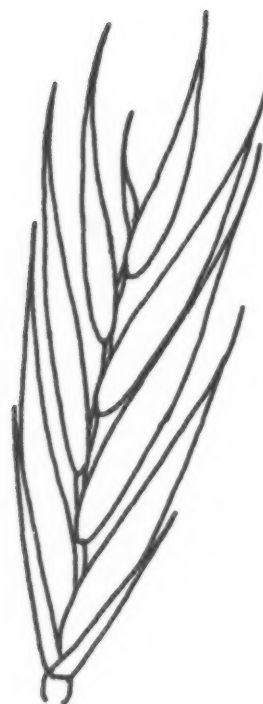
—— RACHILLA



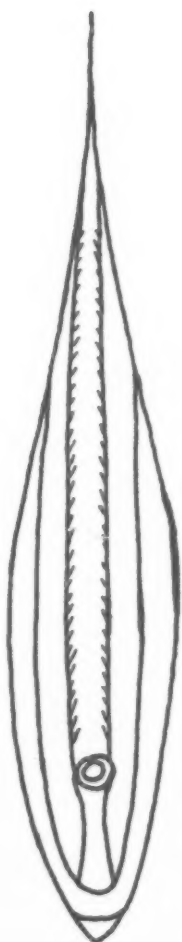
RED FESCUE



INFLORESCENCE



SPIKELET



SEED
119





FLORET 

GLUMES 

—AWN

—— LEMMA

—— PALEA

—— RACHILLA



ORCHARDGRASS



INFLORESCENCE



SPIKELET



STEM



SEED



3





FLORET —————

GLUMES 

— FLATTENED

— PALEA

— LEMMA

RACHILLA —————





INTERMEDIATE WHEATGRASS

1



INFLORESCENCE



SPIKELET



SEED





FLORET



GLUMES

PALEA



LEMMA



RACHILLA



CRESTED WHEATGRASS



INFLORESCENCE



SPIKELET



SEED



FLORET—

GLUMES 

—AWN

—LEMMMA

—PALEA

—RACHILLA





PERENNIAL RYEGRASS



INFLORESCENCE



SPIKELET



SEED





FLORET —

GLUME (I) —

— PALEA

— LEMMA

— RACHILLA —





TALL OATGRASS



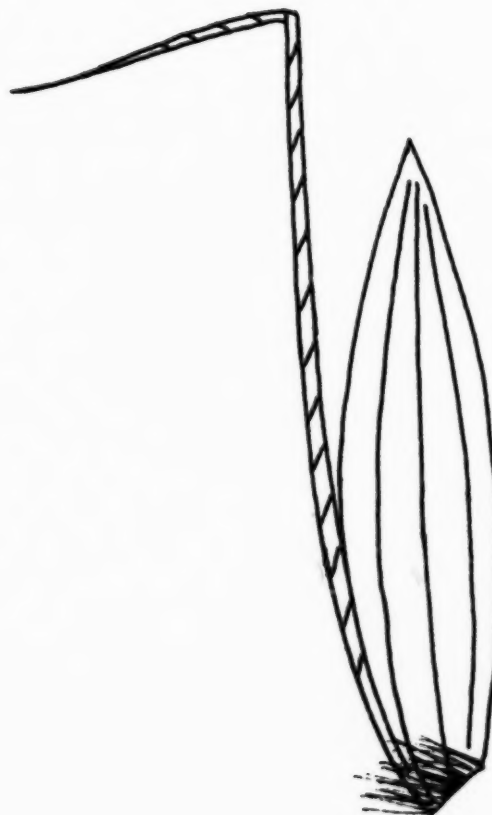
INFLORESCENCE



SPIKELET



SEED



FLORET





FLORET —

GLUMES

—AWN

PUBESCENCE —





REED CANARYGRASS



INFLORESCENCE



SPIKELET



SEED





FLORET



GLUMES



STERILE
FLORETS



RED TOP



INFLORESCENCE



SPIKELET



SEED





FLORET

GLUMES

— PALEA

— LEMMA

PUBESCENCE —



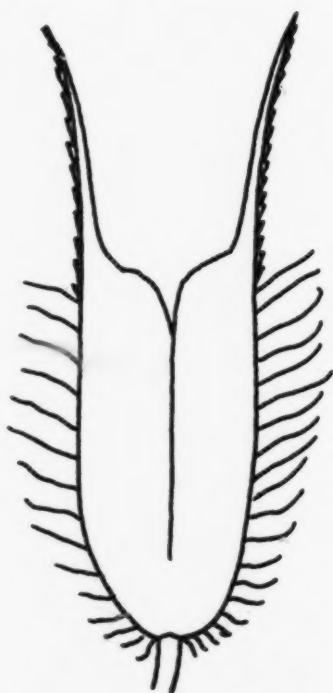
TIMOTHY



INFLORESCENCE



SEED



GLUMES



FLORET

WEEDS

SECTION V

TRANSPARENCY MASTERS FOR CROP AND WEED IDENTIFICATION

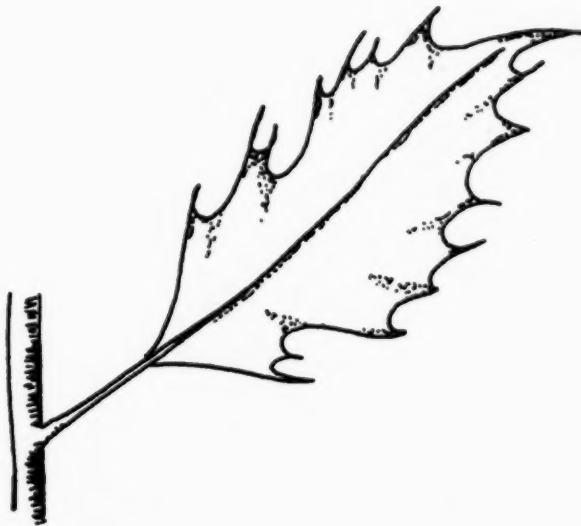
Dwane G. Miller Gilbert A. Long Clarence E. Manning

TABLE OF CONTENTS

SECTION V: WEED IDENTIFICATION

Canada Thistle	138
Dalmatian Toadflax	140
Leafy Spurge	142
Quackgrass	144
Russian Knapweed	146
Skeleton Weed	148
White Top	149
Wild Morning-Glory	151
Buckhorn Plantain	153
Dodder	155
Curly Dock	157
Fanweed	159
Klamath Weed	161
Goatweed	162
Puncture Vine	163
Sheep Sorrel	165
Wild Oats	167
Yellow Starthistle	169
Black Nightshade	171
Bachelors Button	173
Cow Cockle	174
Bull Thistle	176
Dog Fennel	178
Downy Bromegrass	180
Cheatgrass	181
Gromwell	182
Henbit	183
Jim Hill Mustard	185
Knotweed	187
Prostrate Knotweed	188
Lambs-Quarters	189
Mallow	191
Mares-Tail	193
Prickly Lettuce	195
China Lettuce	196
Rough Pigweed	197
Pigweed	198
Russian Thistle	199
Salsify	201
Wild Salsify	202
Tarweed	203
Wild Buckwheat	205
Yarrow	207
Hairy Vetch	209

CANADA THISTLE



LEAF



SEED

CANADA THISTLE

(*Cirsium arvense* (L.) Scop)
Cursed thistle, Devil's thistle

Rose-purple
flowers

Leaves irregular,
deeply cut rela-
tively smooth to
spiny margins

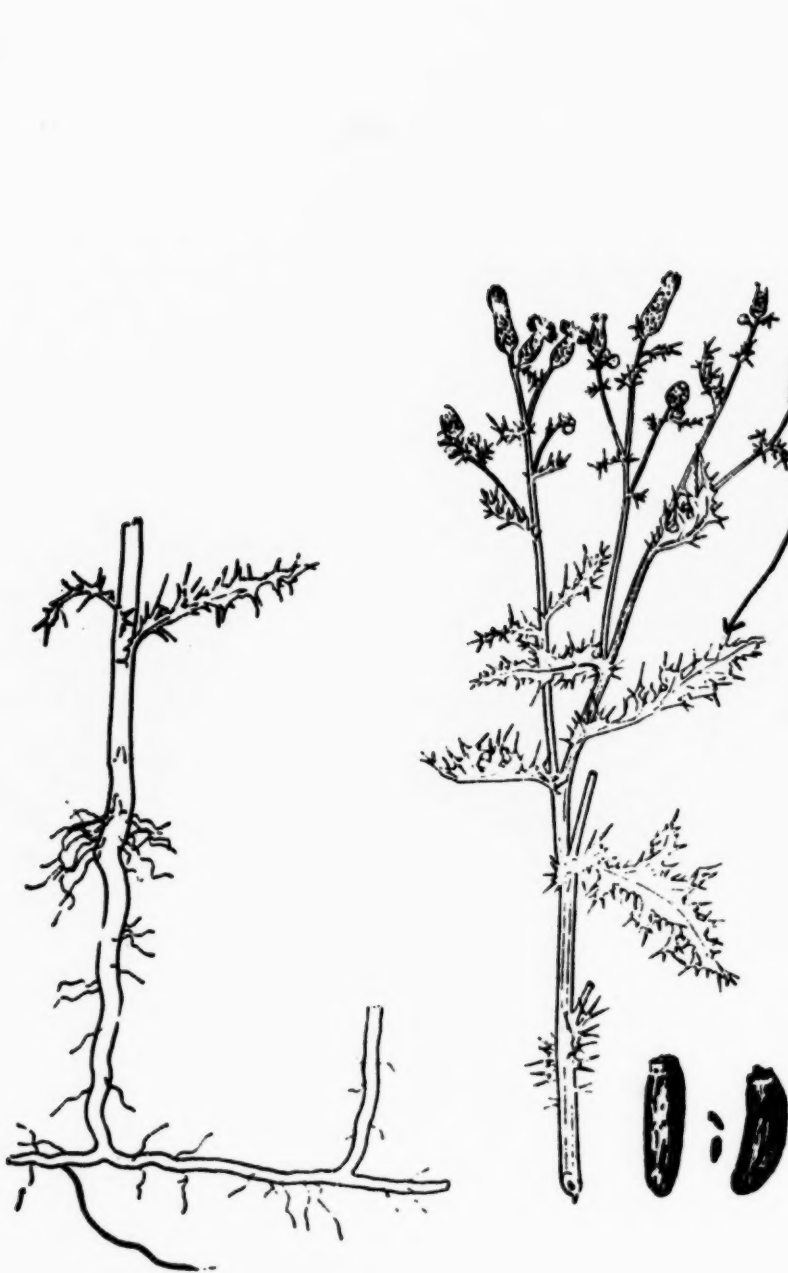
Both male and
female flowers

Plant erect branch-
ing near the top

Grows 2 to 7 feet
high

Reproduces by seed
and by underground
rootstocks

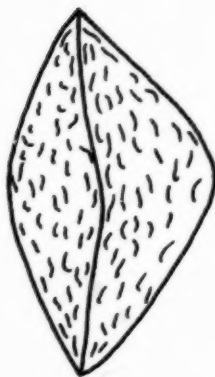
Perennial



DALMATIAN TOADFLAX

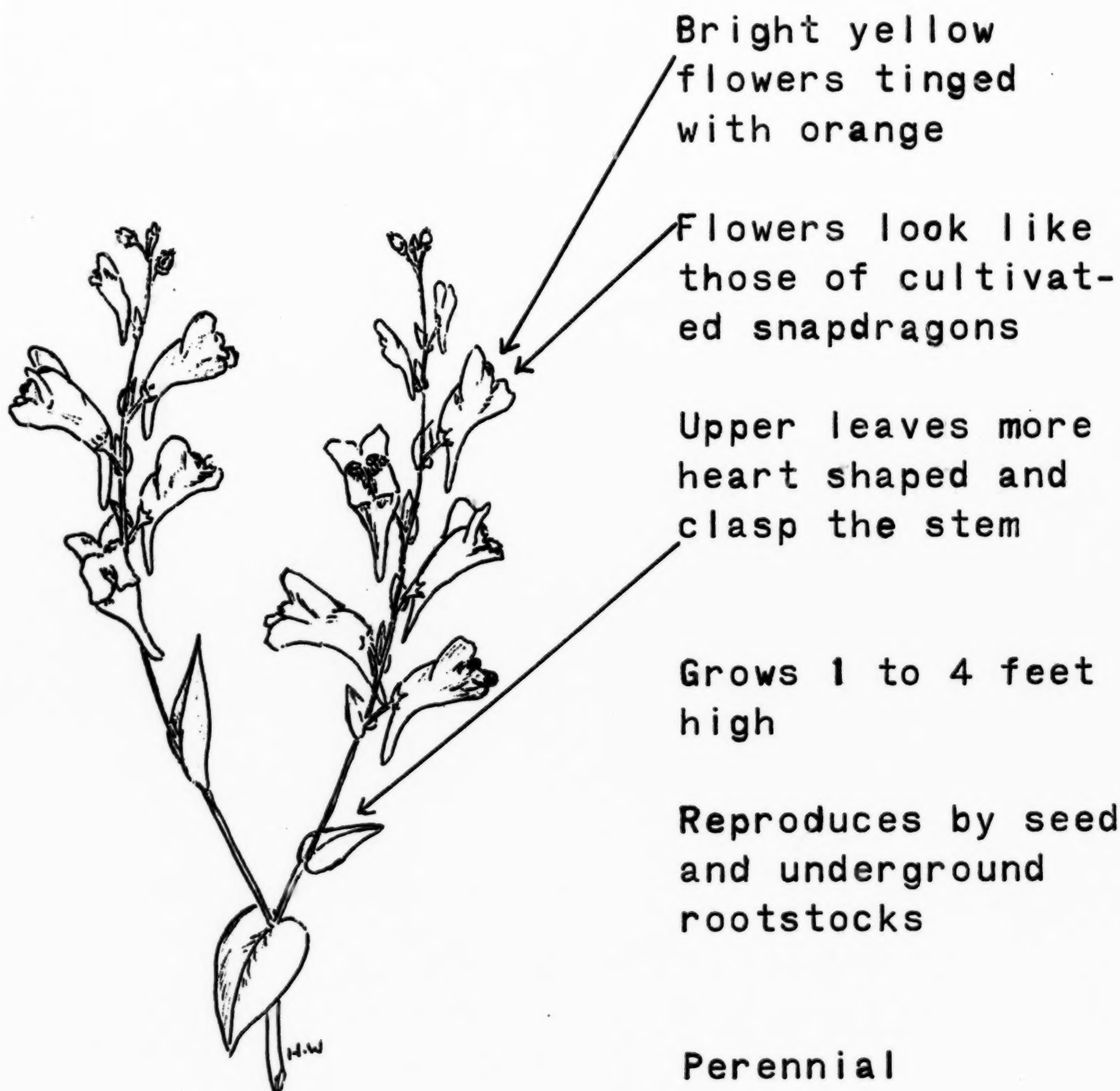


LEAF

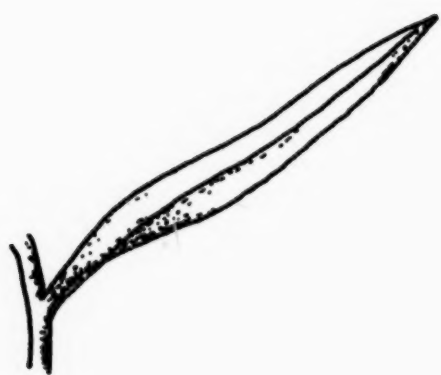


SEED

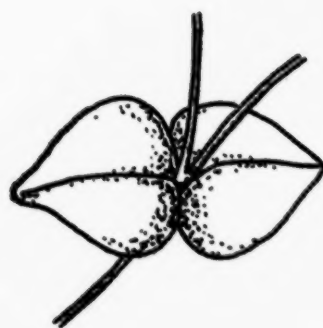
DALMATIAN TOADFLAX
(*Linaria Dalmantica*)



LEAFY SPURGE



LOWER LEAF



UPPER LEAF



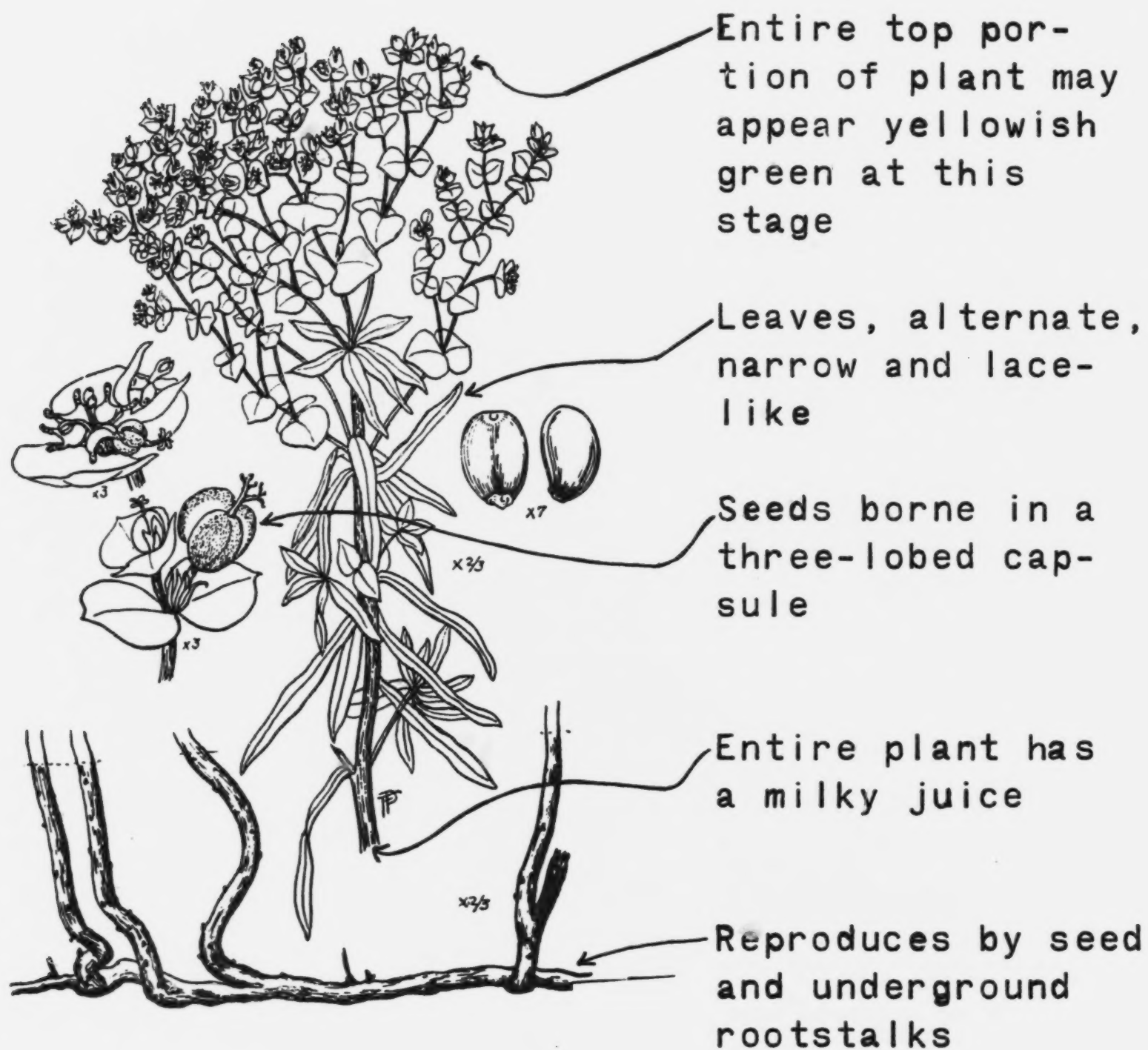
CAPSULE



SEED

LEAFY SPURGE

(*Euphorbia esula* (L.) Hill)



Perennial

QUACKGRASS



INFLORESCENCE



SPIKELET



SEED

QUACKGRASS

(*Agropyron repens* (L.) Beauv.)

Couchgrass, Devil's grass

Inconspicuous
flowers

Grows 1 to 4 feet
tall

Leaves are some-
what rough

Lower leaf sheaths
are somewhat hairy

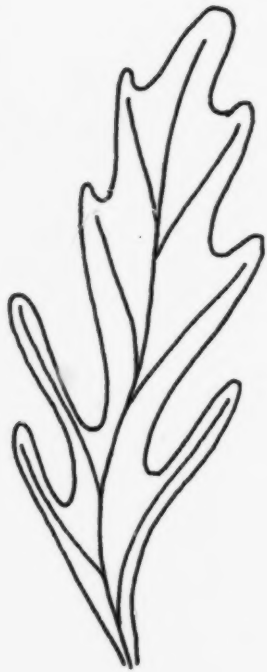
At base of each
leaf a small pair
of claws (auricles)
clasp the stem

Forms dense mat of
white to straw-
colored rootstocks

Perennial



RUSSIAN KNAPWEED



LOWER LEAF



UPPER LEAF



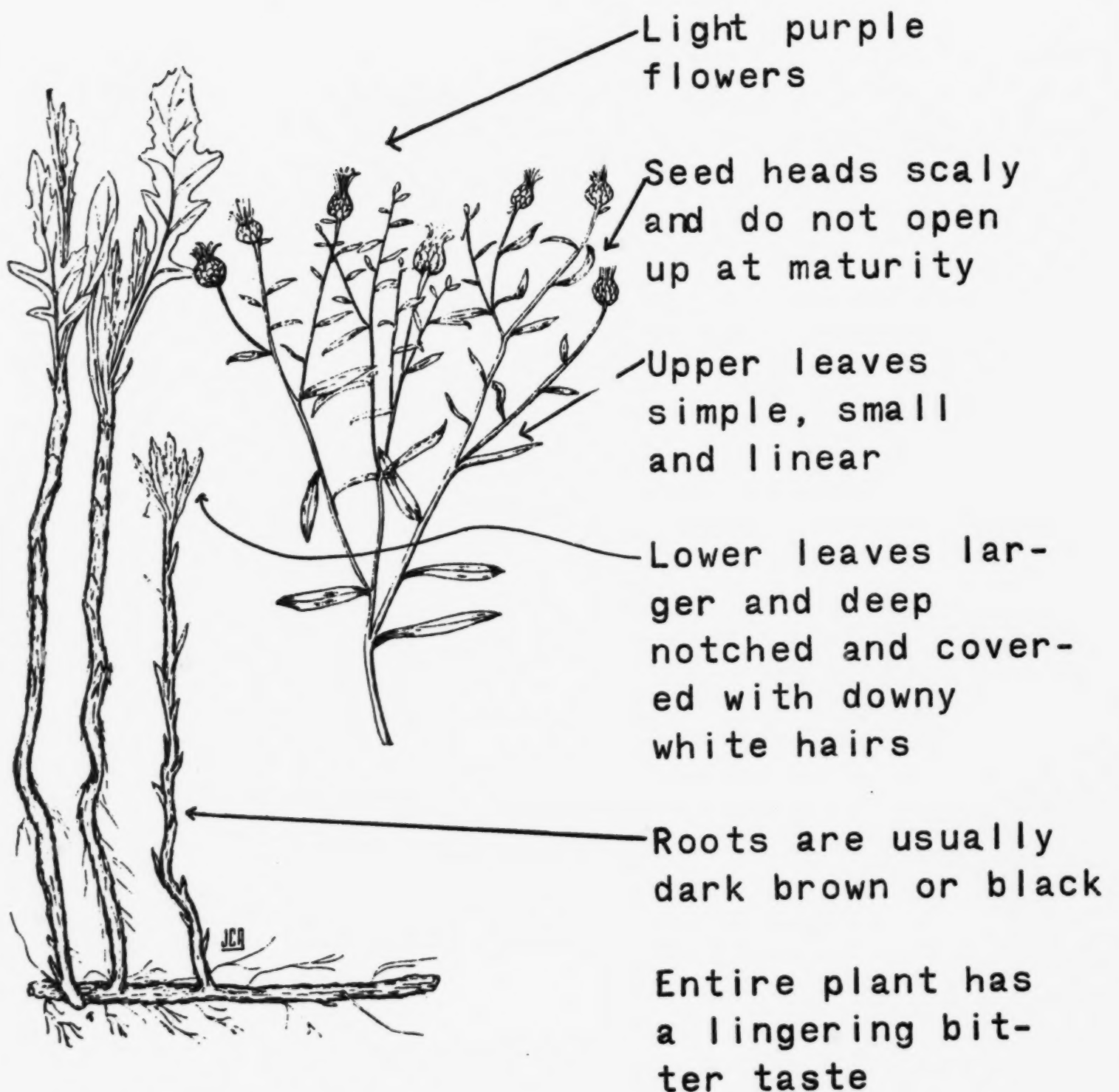
CAPSULE



SEED

RUSSIAN KNAPWEED

(*Centaurea repens* Pall.)



Perennial

147

Reproduces by seeds and rootstocks

SKELETON WEED



BASAL LEAF



UPPER LEAVES

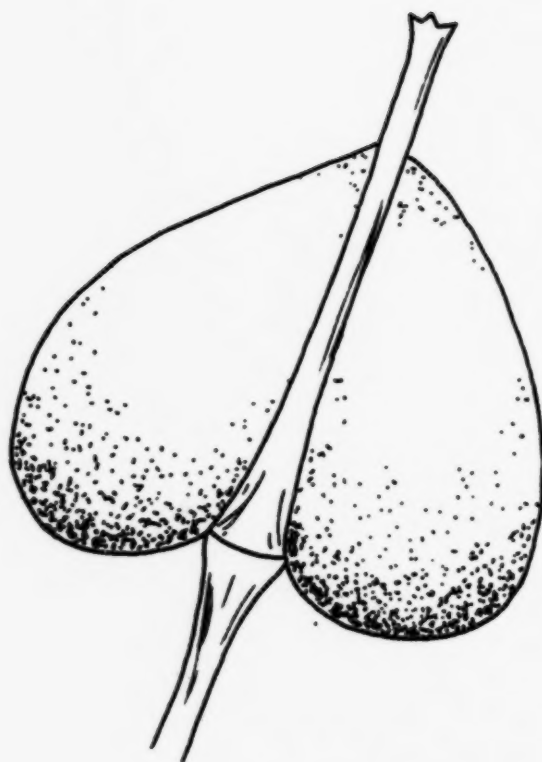


SEED

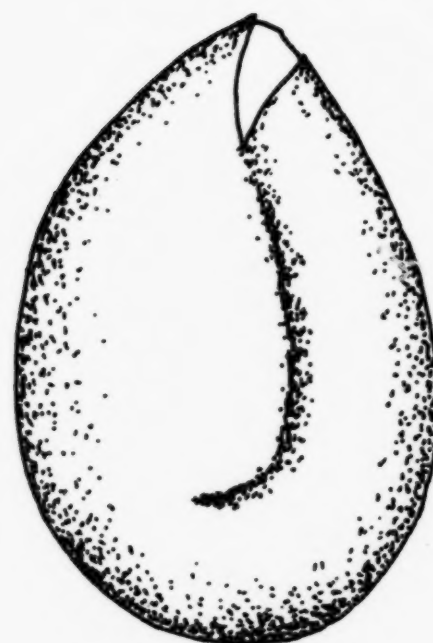
WHITE TOP



LEAF



SEED POD

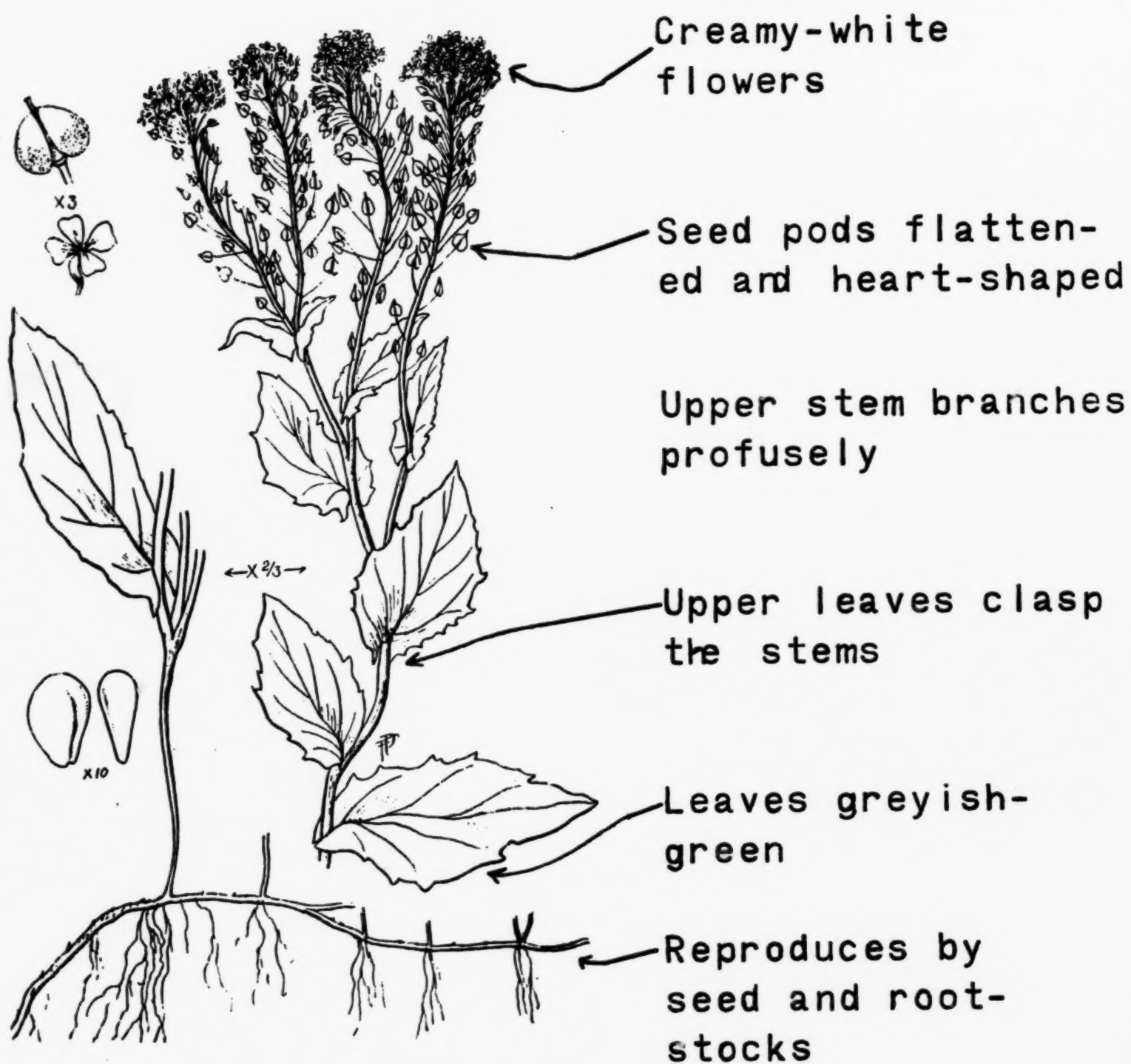


SEED

WHITE TOP

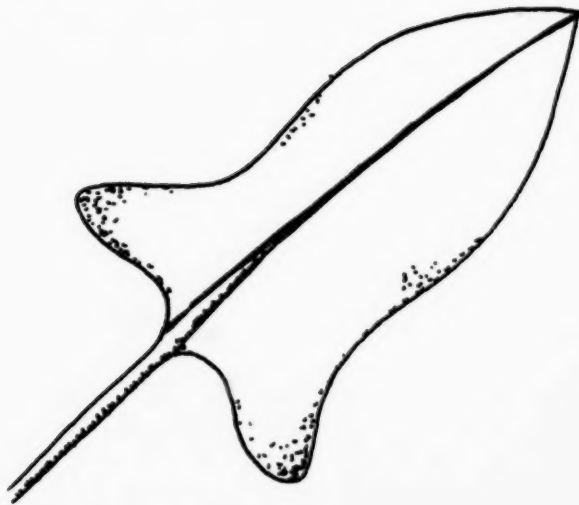
(*Cardaria draba*)

Hoarycress, Perennial peppergrass

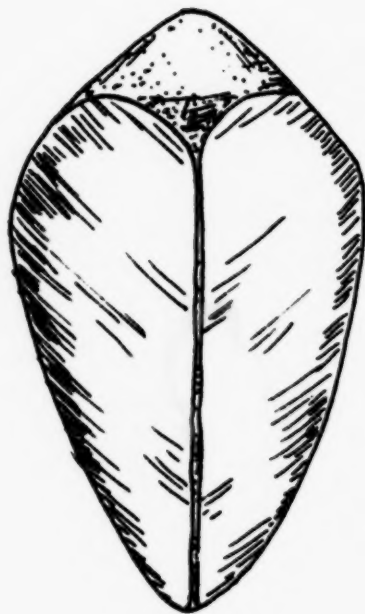


Perennial

WILD MORNING-GLORY



LEAF



SEED

WILD MORNING-GLORY

(*Convolvulus arvensis* L.)
Field bindweed, Creeping jenny,
European bindweed



White to pinkish,
funnel-shaped flow-
ers

Leaf size and shape
may vary somewhat
but are essentially
heart or arrow-
shaped

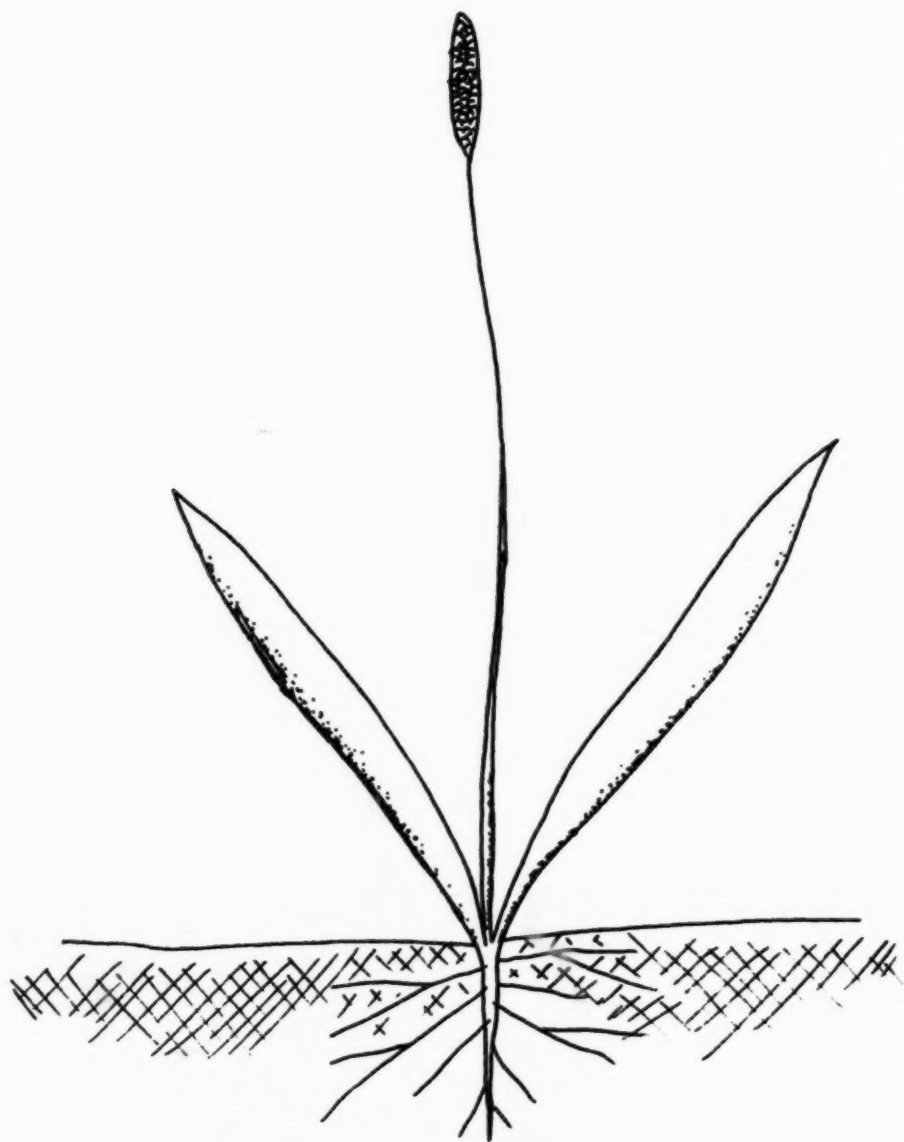
Has 2 bracts about
midway on flower-
ing stalk

Stems are prostrate
or twining

Reproduces by seed
and underground
rootstalks

Perennial

BUCKHORN PLANTAIN



PLANT

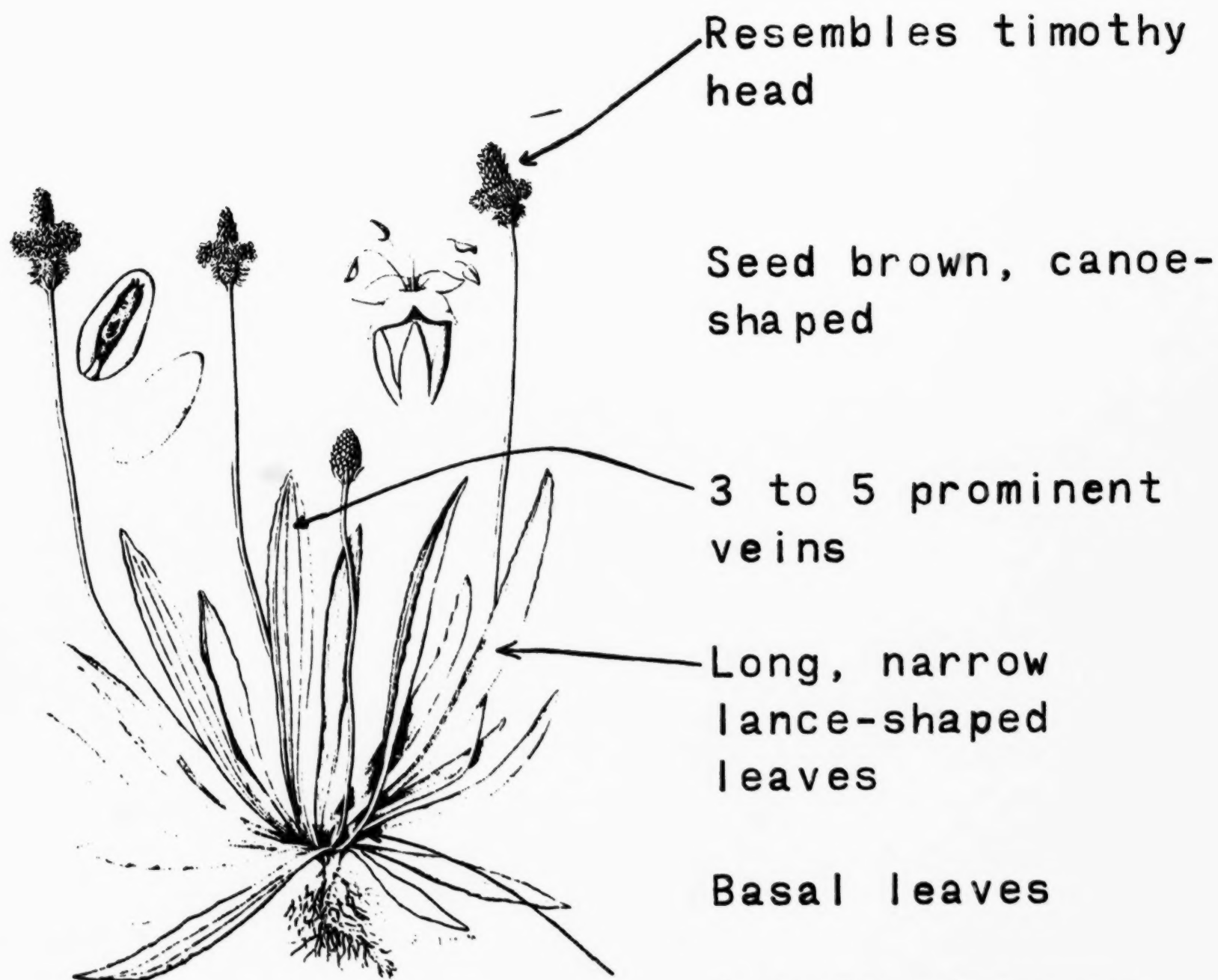


SEED

BUCKHORN PLANTAIN

(*Plantago lanceolata*)

Buckhorn, Ribgrass



Resembles timothy head

Seed brown, canoe-shaped

3 to 5 prominent veins

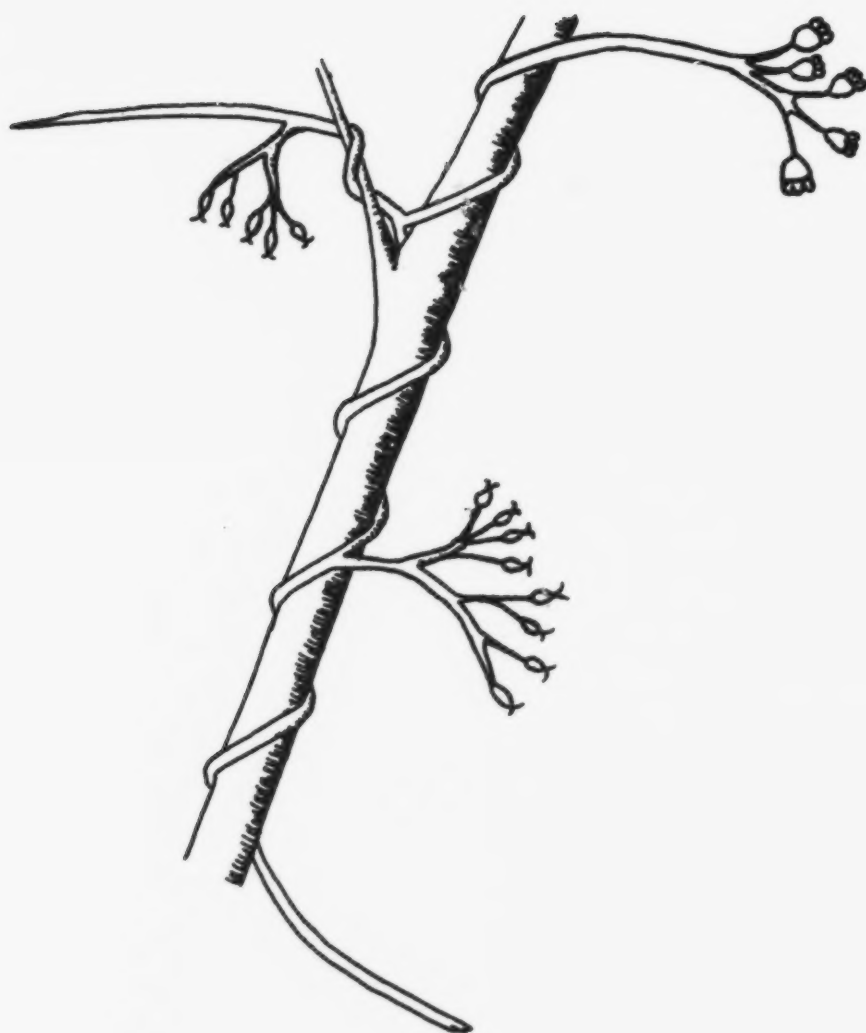
Long, narrow lance-shaped leaves

Basal leaves

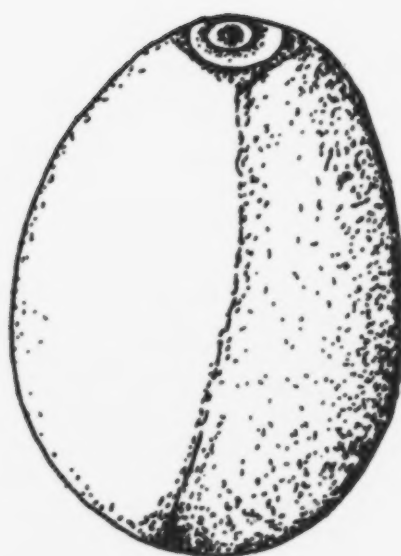
A tuft of brown hairs are at the base of each leaf

Perennial

DODDER



PLANT

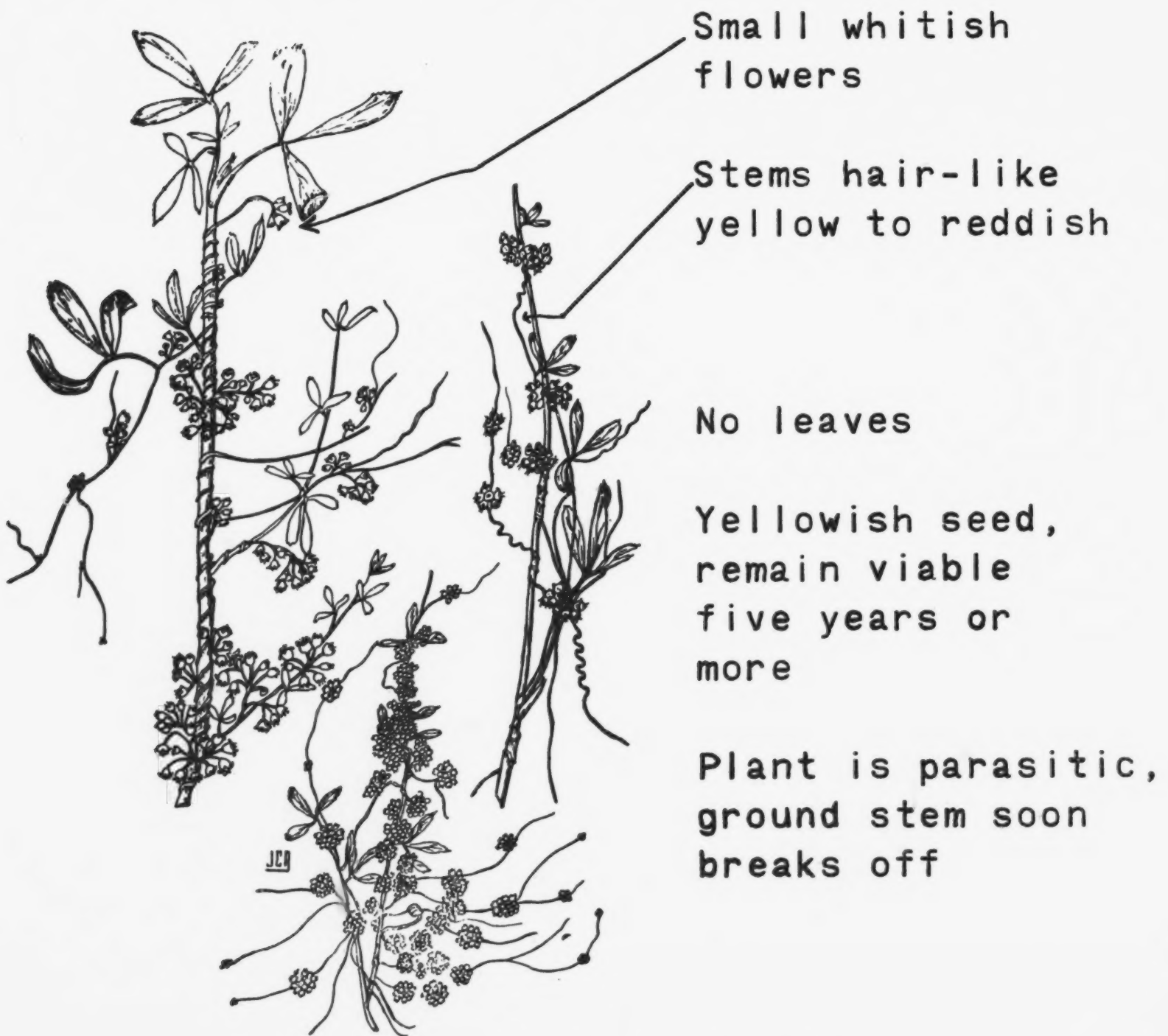


SEED

DODDER

(*Cuscuta* sp.)

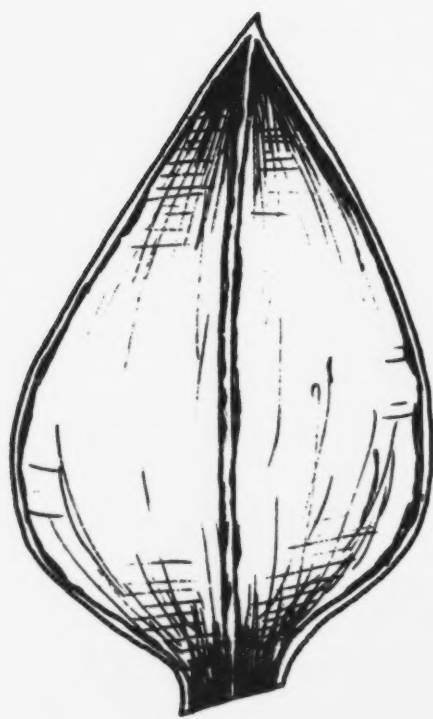
Devil's hair, Field dodder



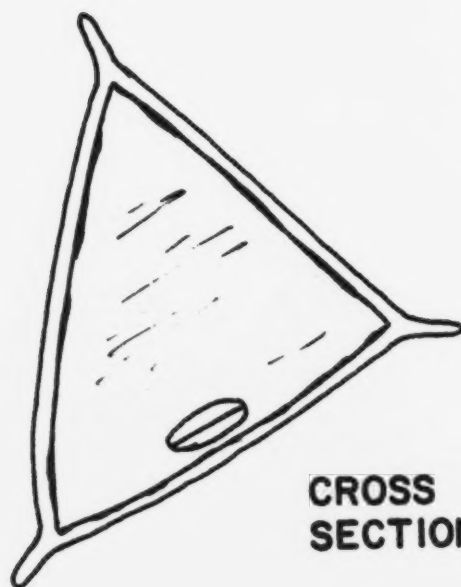
CURLY DOCK



LEAVES



SEED



CROSS
SECTION

CURLY DOCK

(*Rumex crispus* L.)

Curled dock, Indian tobacco, Sour dock

Flowers form a
triple winged pod

Reddish brown at
maturity

Upper leaves clasp-
ing and less wavy
than the lower
leaves

Lower leaves 6
to 8 inches long
and wavy

Reproduces by
seed

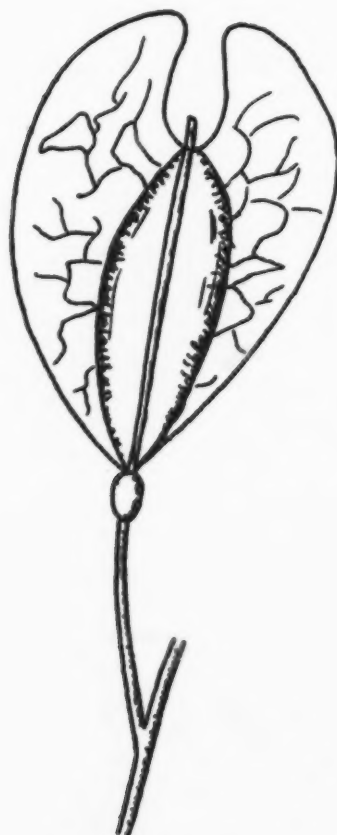
Perennial having
a deep taproot



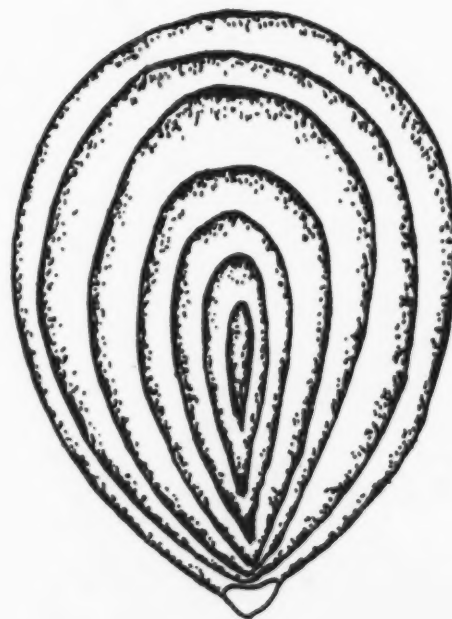
FANWEED



LEAVES



CAPSULE

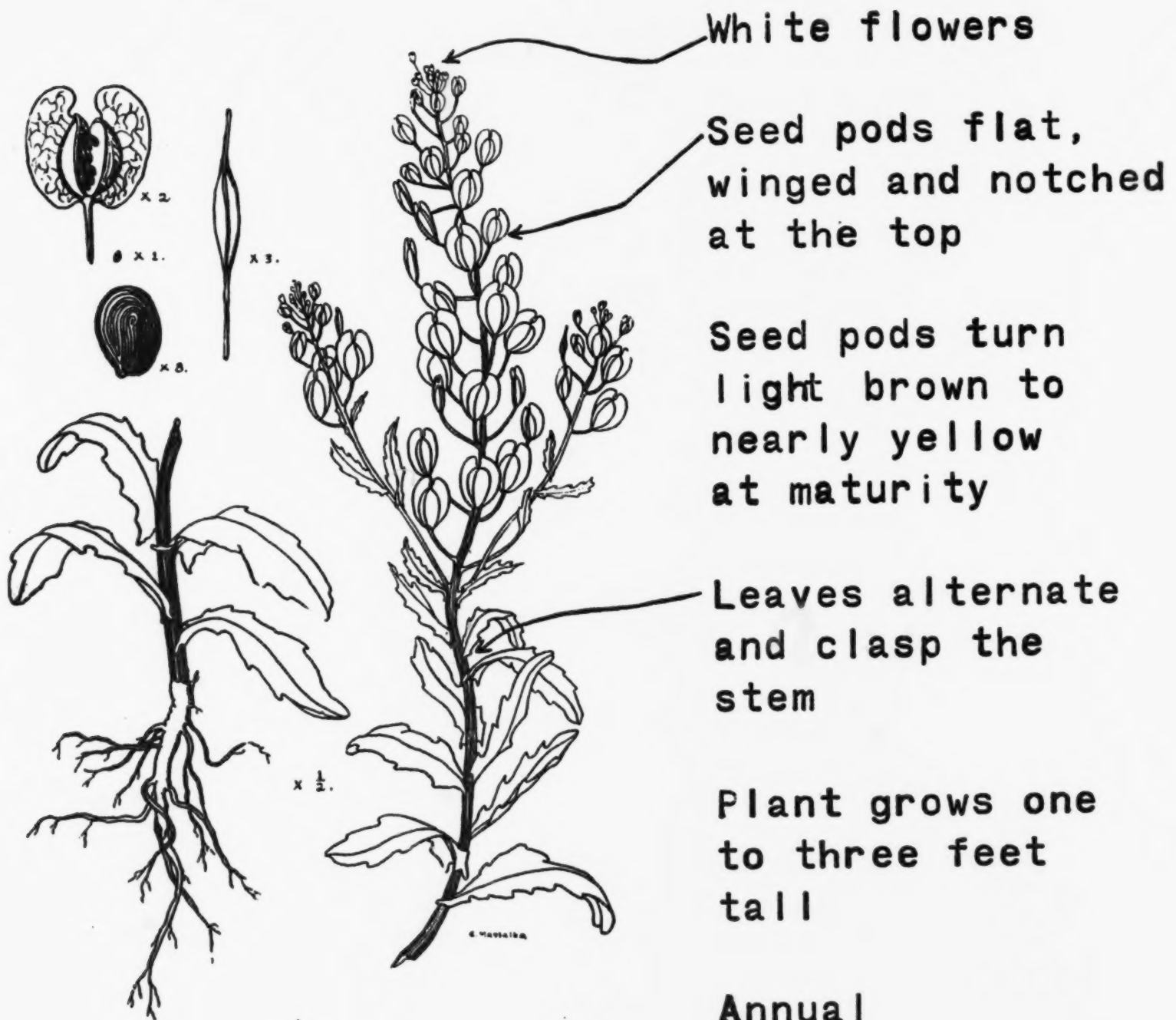


SEED

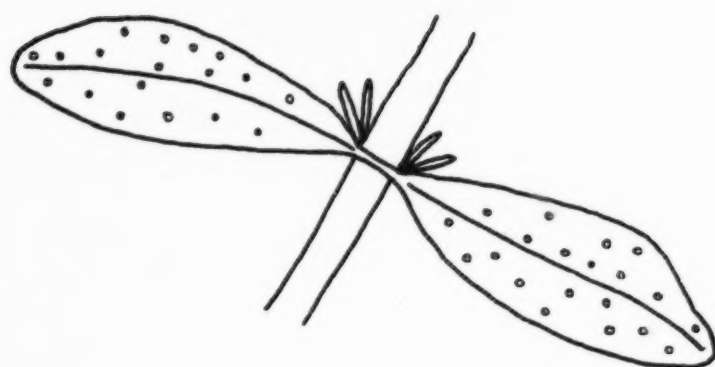
FANWEED

(*Thlaspi arvense* L.)

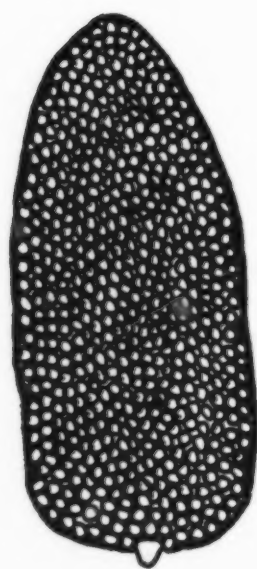
Pennycress, Frenchweed, Stinkweed



KLAMATH WEED



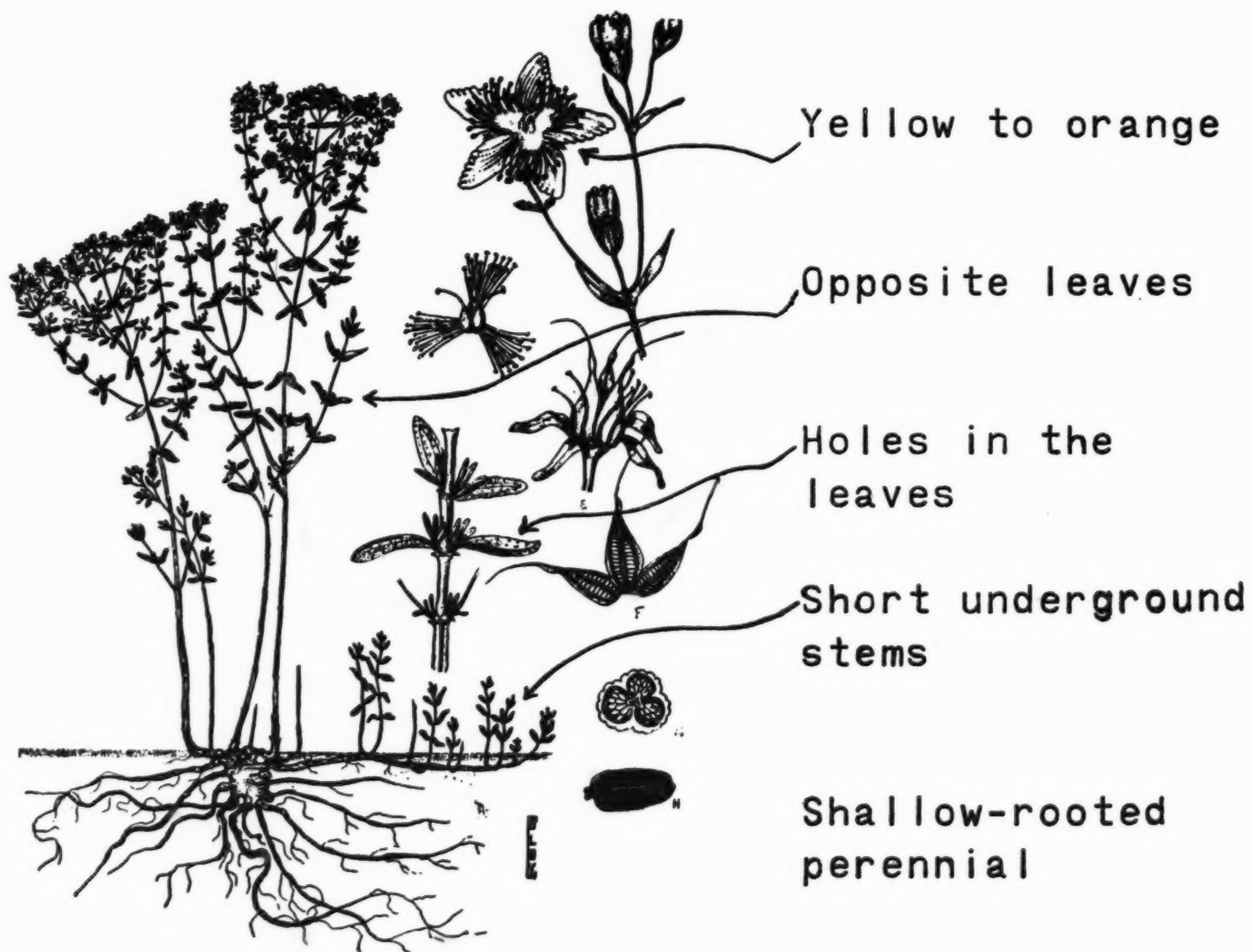
LEAVES



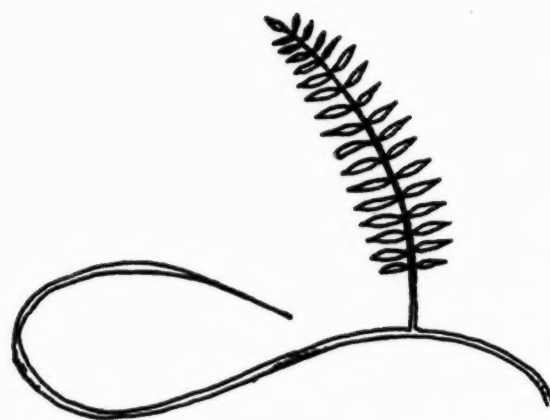
SEED

GOATWEED

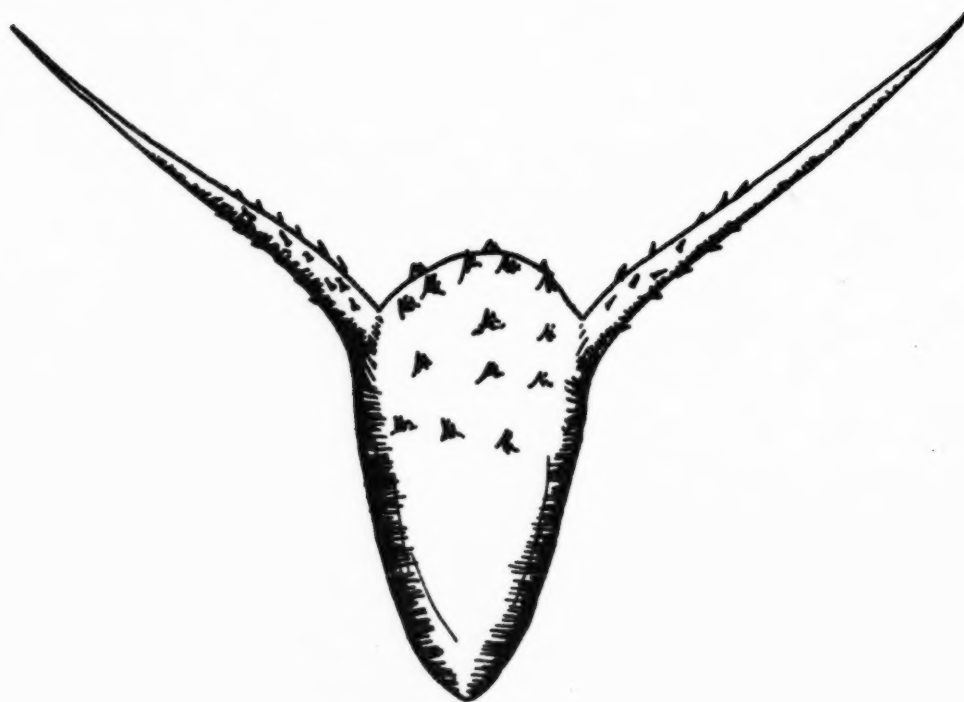
(*Hypericum perforatum* L.)
Klamath weed, St. Johnswort



PUNCTURE VINE



LEAF

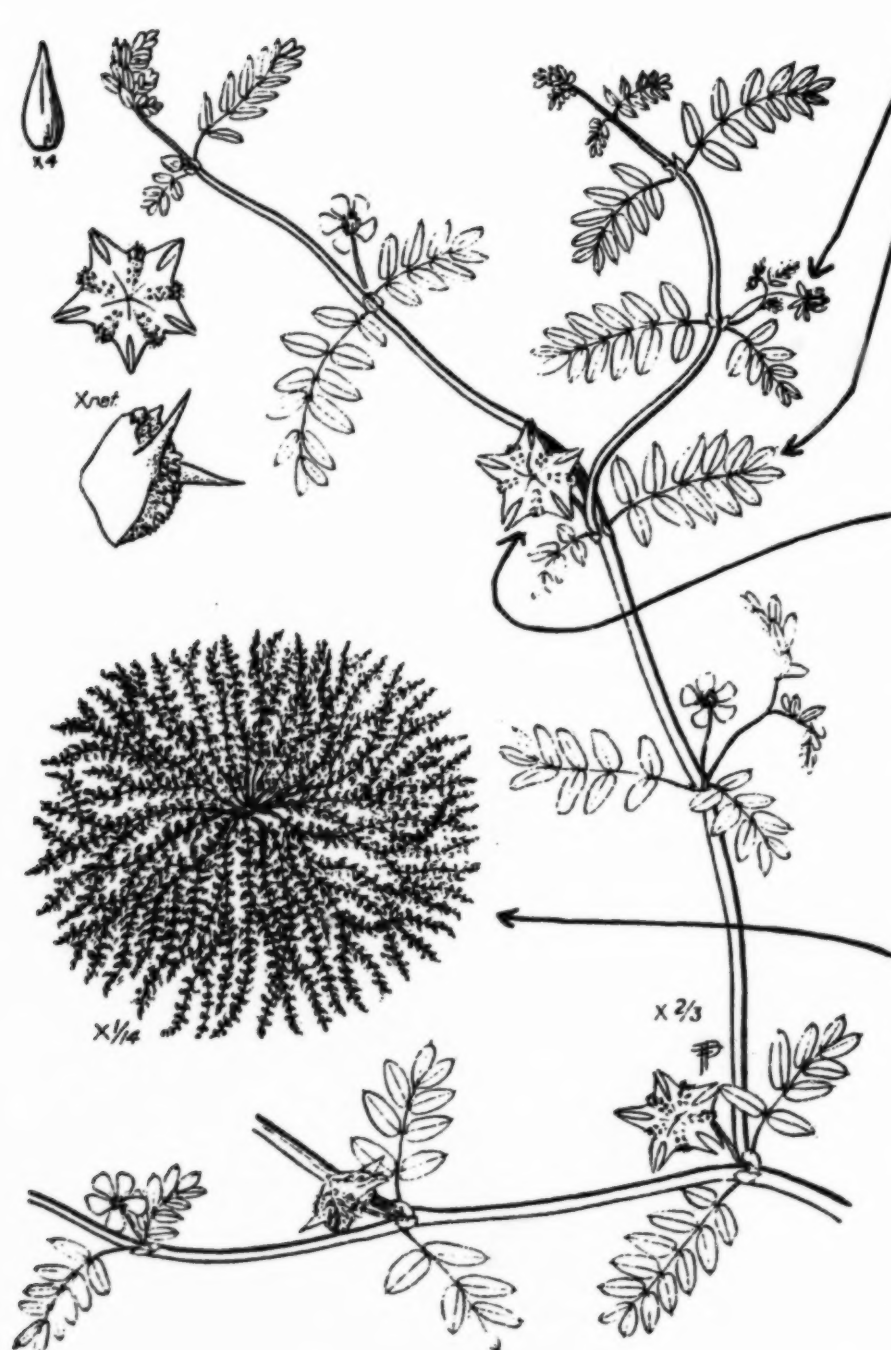


SEED
163

PUNCTURE VINE

(*Tribulus terrestris* L.)

Mexican sandbur, Texas sandbur



Yellow flower

Each leaf is composed of several pairs of leaflets

Seed pods contain 5 spiny burs, they readily separate

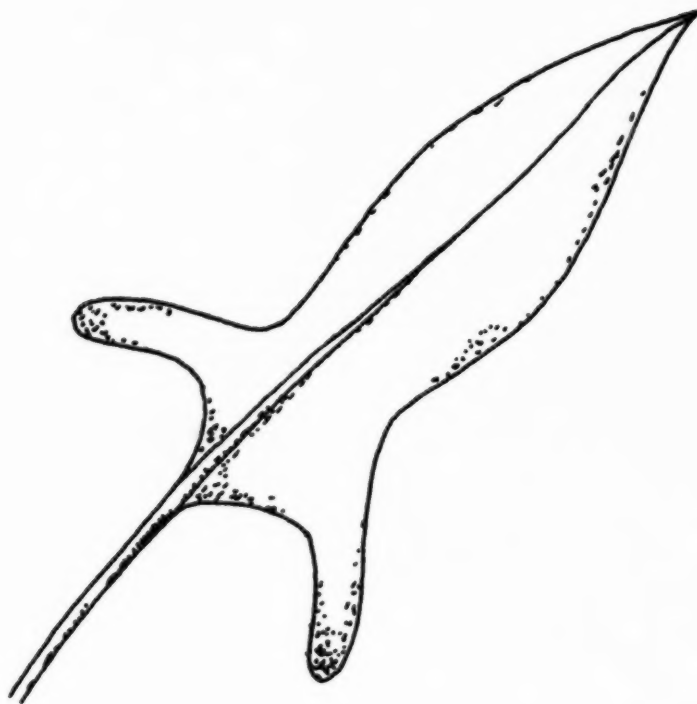
Covered with dense silky hairs

Much branched prostrate plant radiating from taproot

Reproduces by seed

Annual

SHEEP SORREL



LEAF

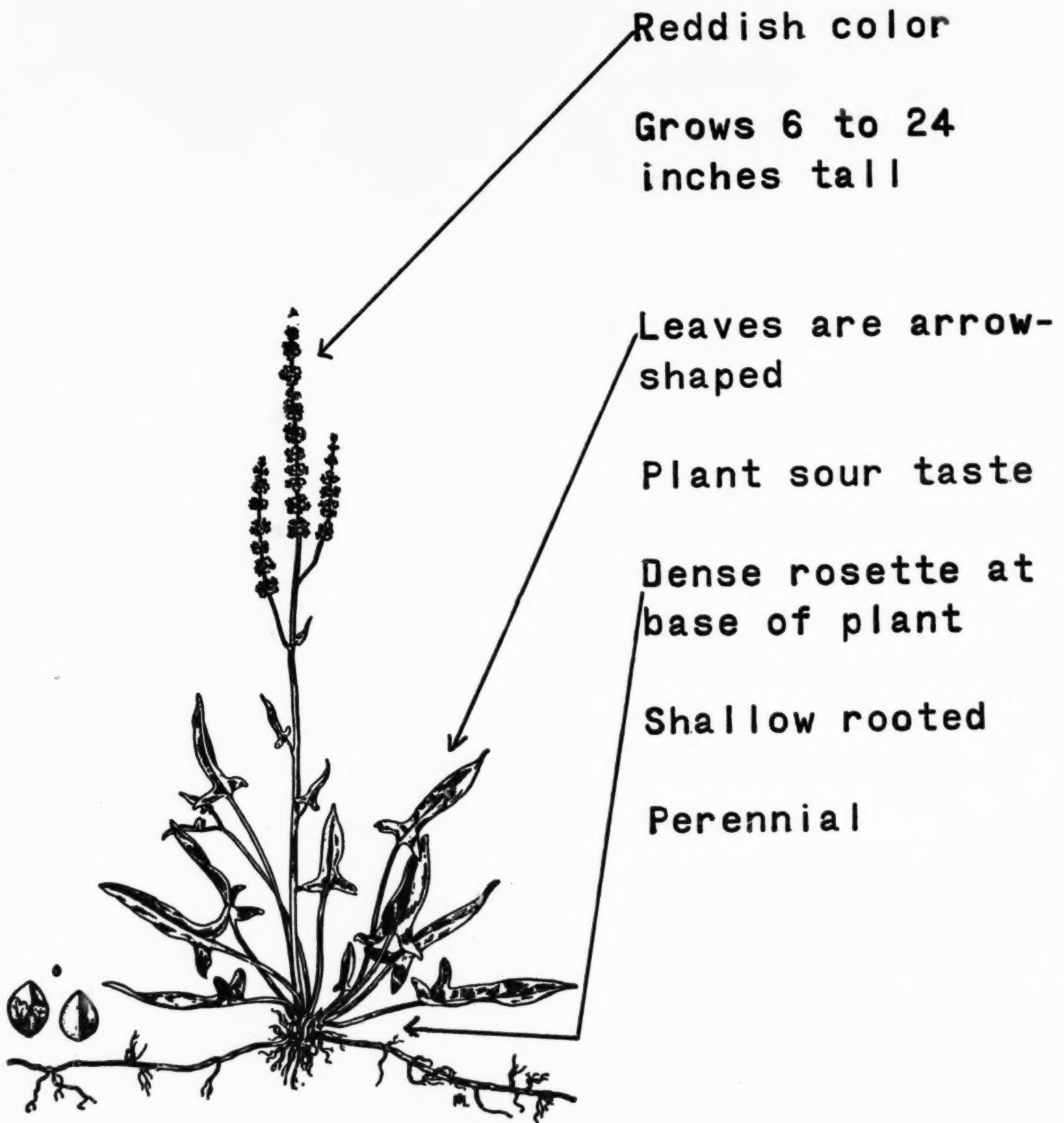


SEED

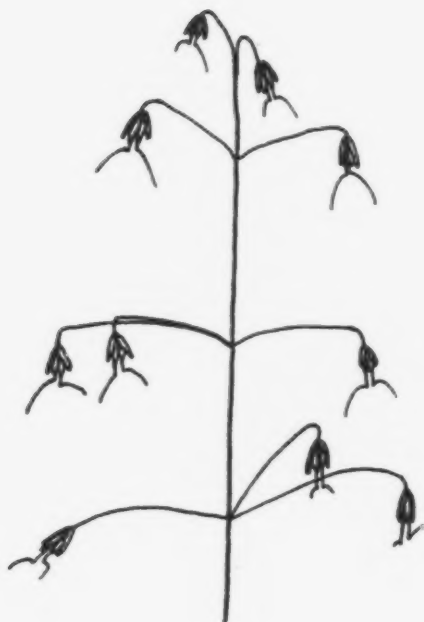
SHEEP SORREL

(*Rumex acetosella* L.)

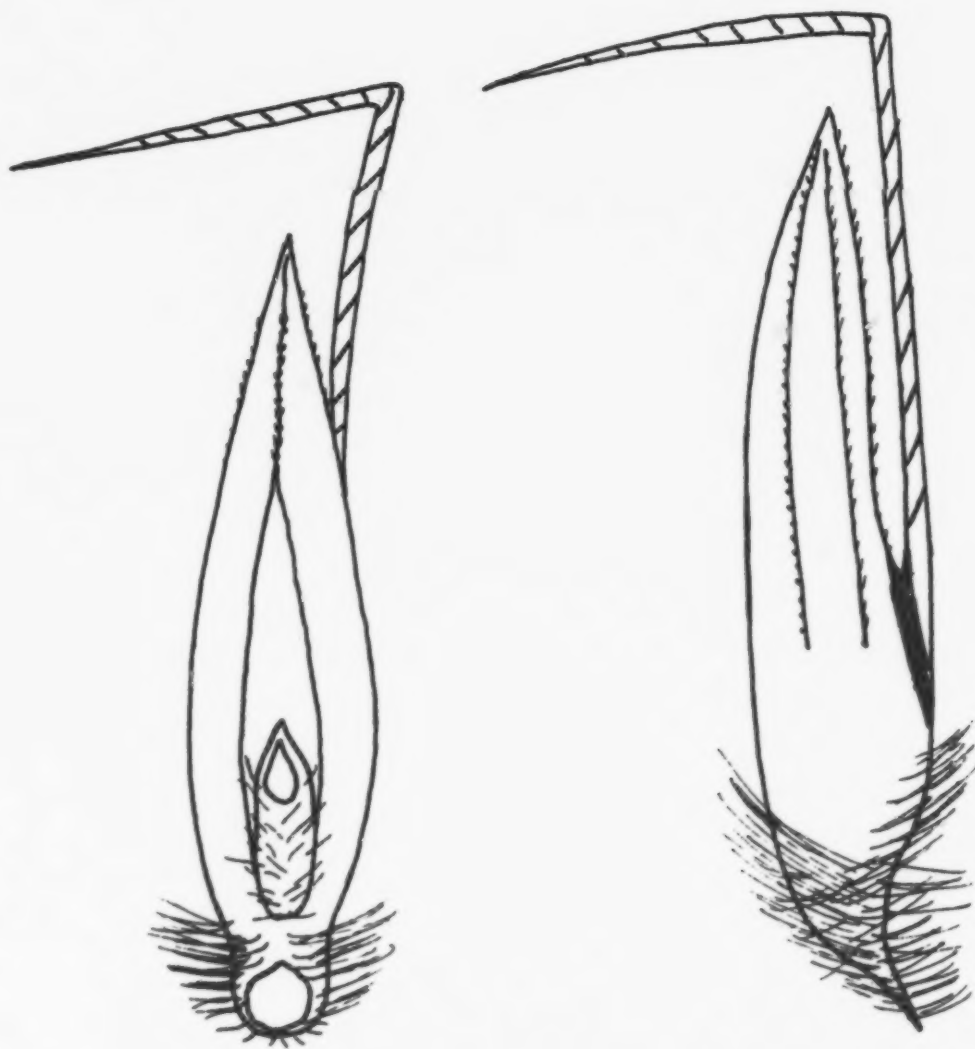
Sourgrass, red sorrel



WILD OATS



INFLORESCENCE



SEED

WILD OATS

(*Avena fatua* L.)

Oatgrass



Resembles tame
oats but has a
more open head
or panicle

Blackish, twisted
and bent awns

Seeds tend to
shatter at
maturity

Seeds have a
"sucker mouth"
and a hairy
rachilla

Reproduce by
seed

Annual

YELLOW STARTHISTLE



LOWER LEAF



UPPER LEAF



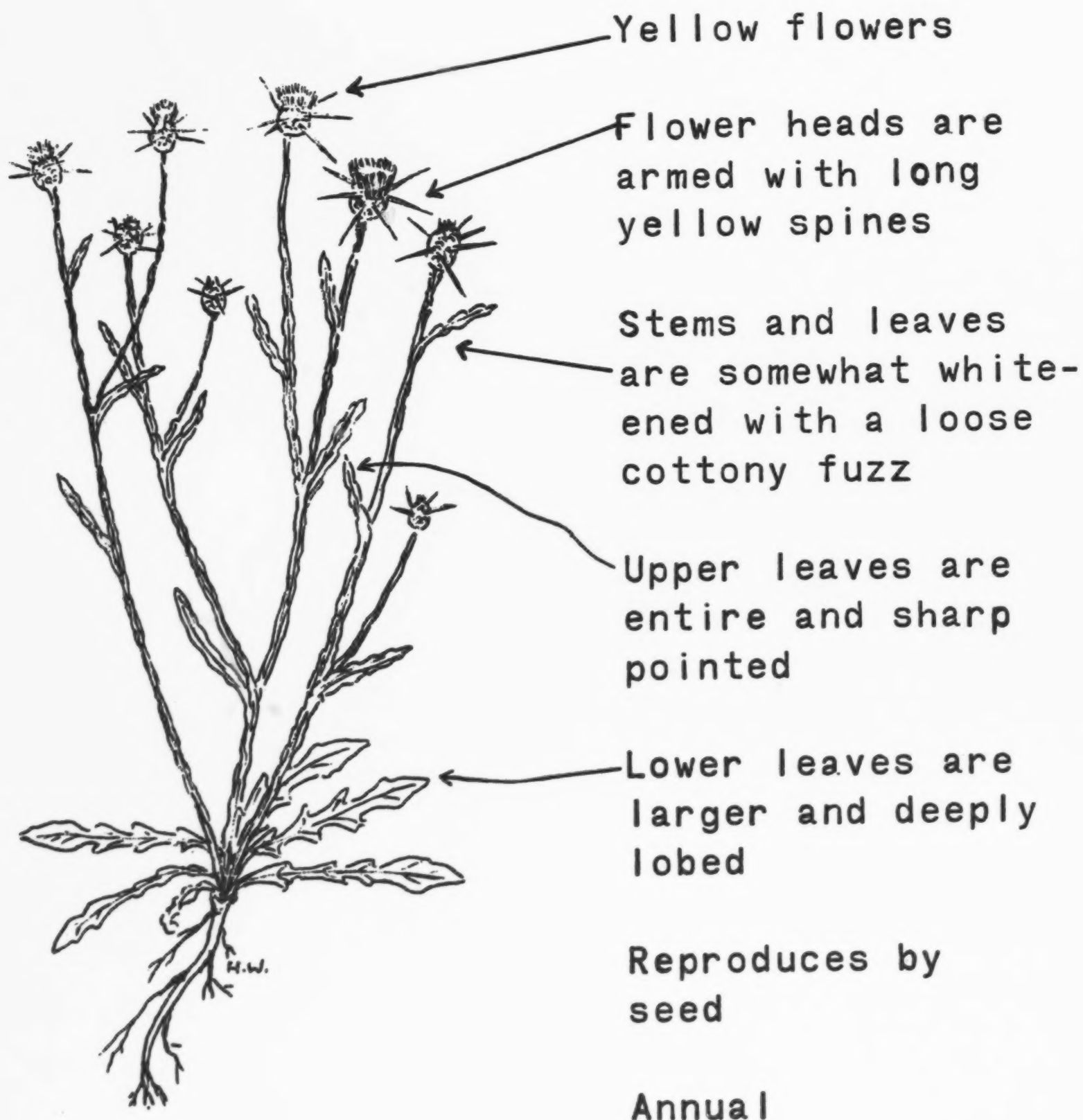
SEED HEAD



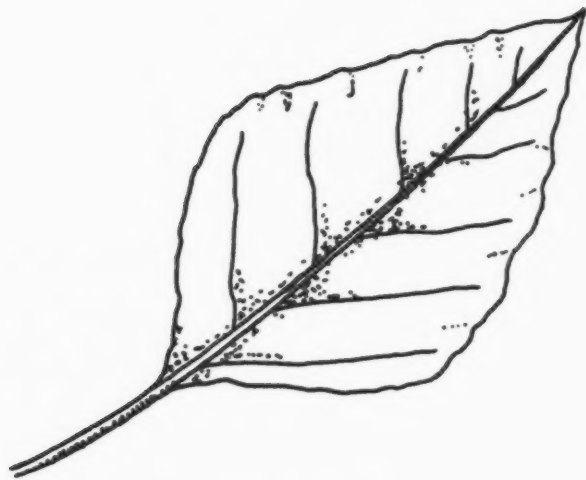
SEED

YELLOW STARTHISTLE

(*Centaurea solstitialis* L.)



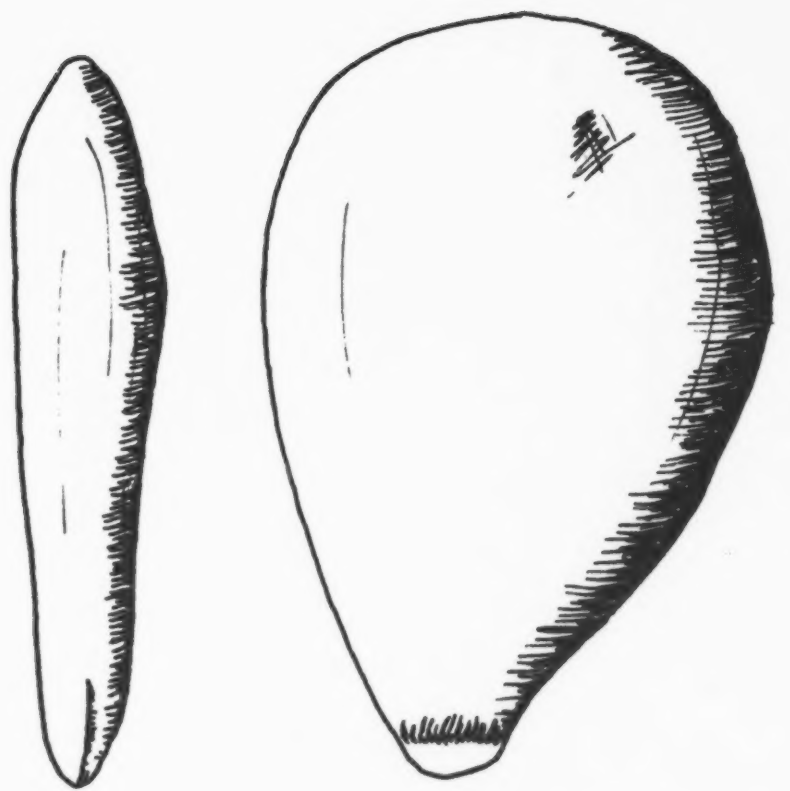
BLACK NIGHTSHADE



LEAF



BERRY

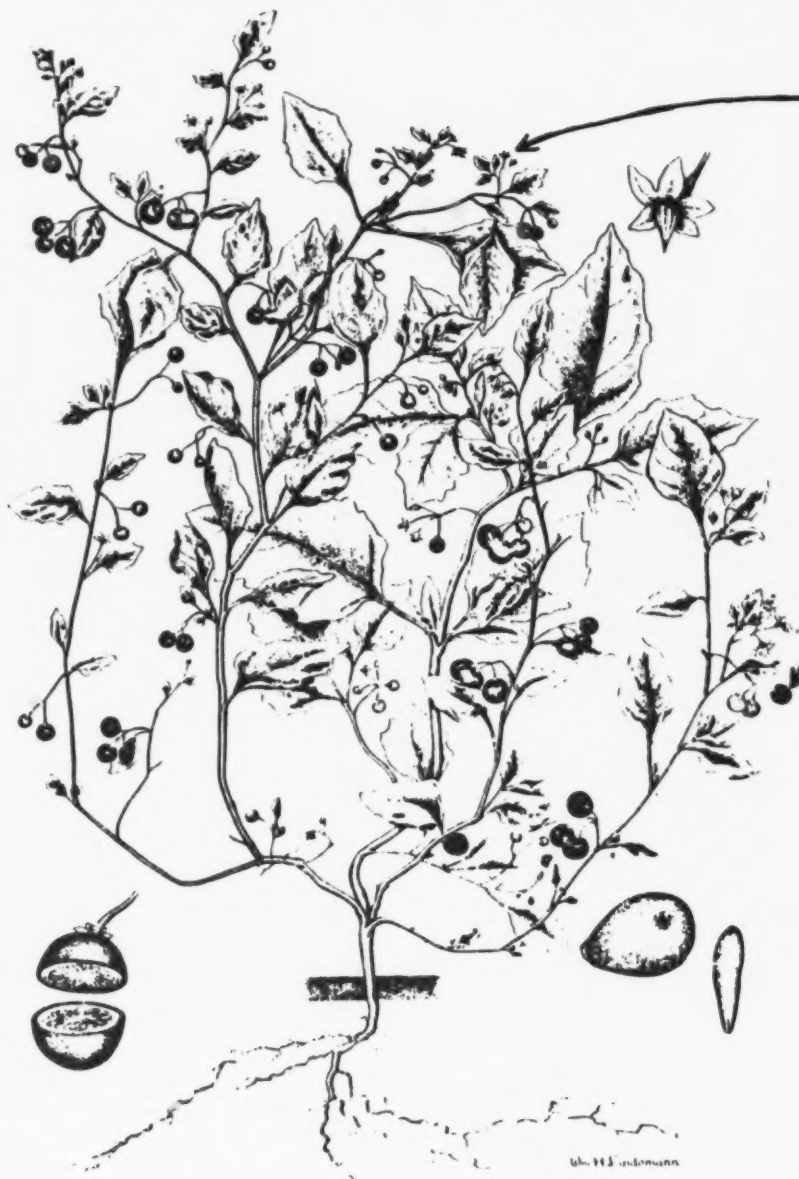


171 SEED

BLACK NIGHTSHADE

(*Solanum nigrum*)

Garden nightshade, Deadly nightshade



Small, white
flowers produced
in clusters

Berries are round
and smooth, turn
black when ripe

Plant often found
in peas, stubble
fields, and in
the summer fallow

Plant freely
branching and
bushy

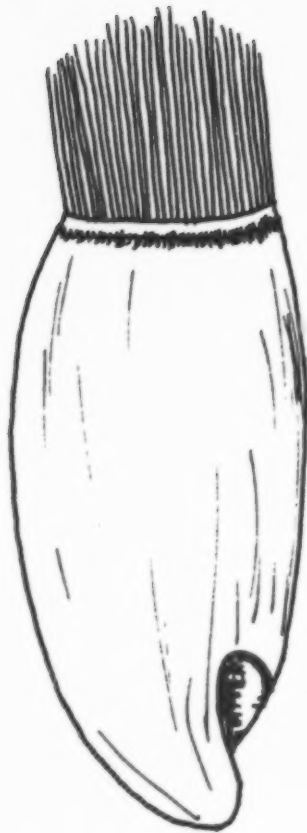
Reproducing by
seed

Annual

BACHELORS BUTTON

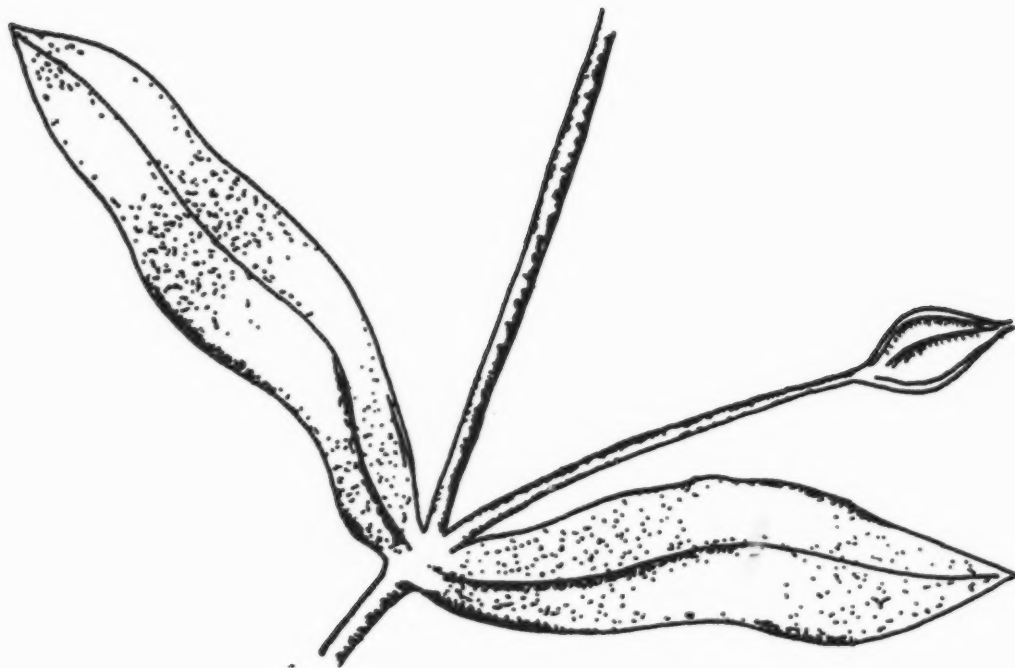


LEAVES



SEED

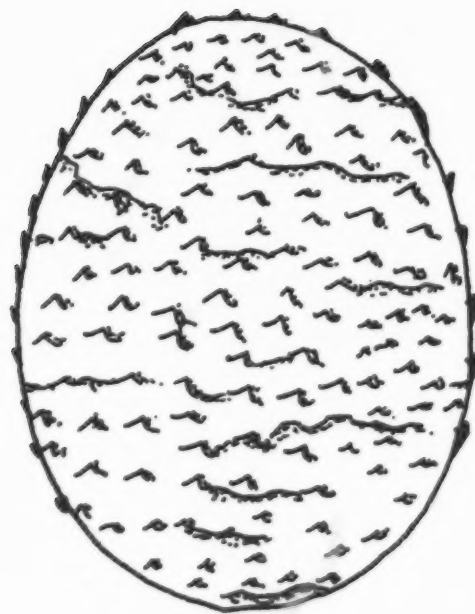
COW COCKLE



LEAVES



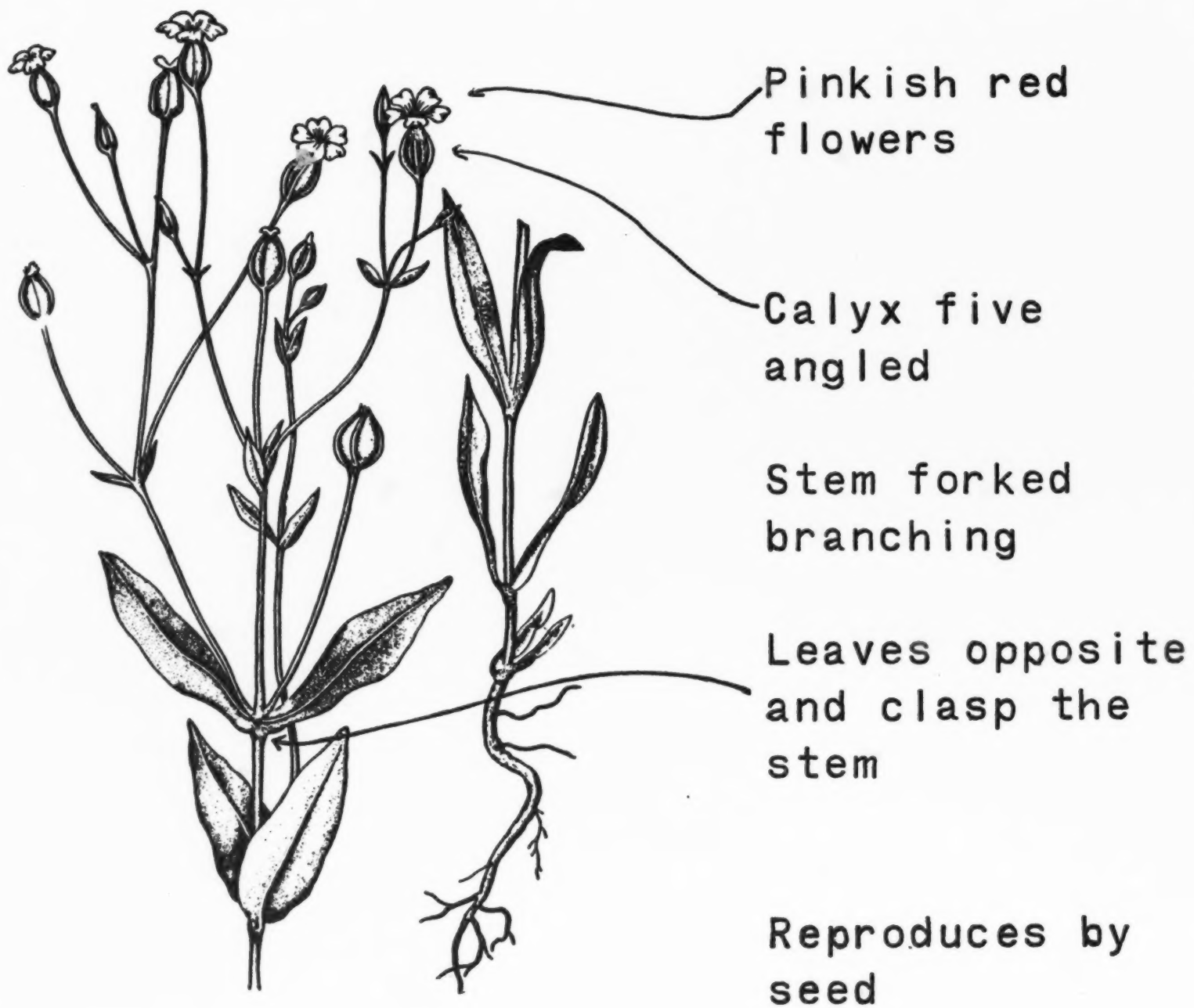
CAPSULE



SEED

COW COCKLE

(*Vaccaria vulgaris* Host.)



Annual

BULL THISTLE



LEAF

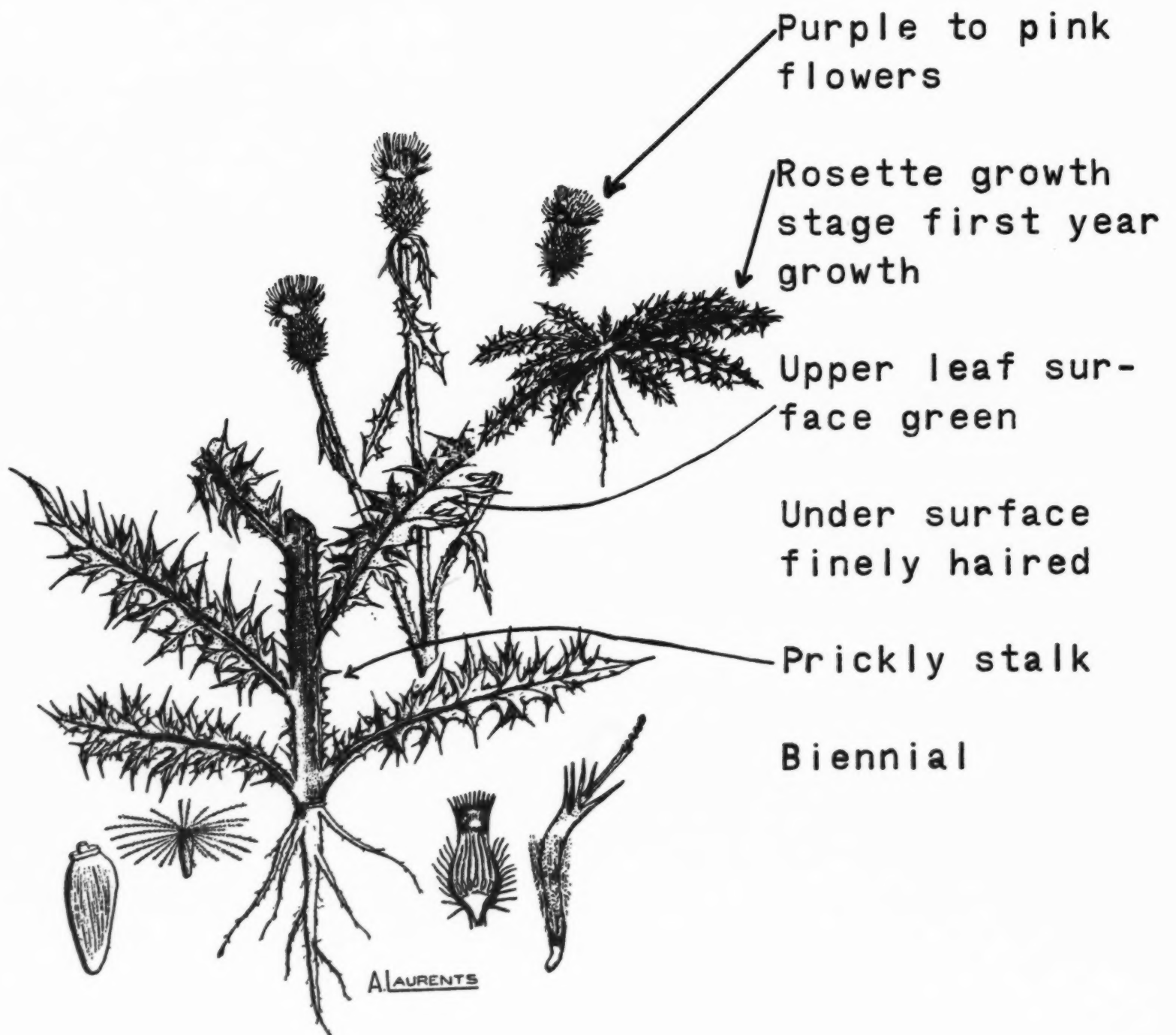


SEED

BULL THISTLE

(*Cirsium lanceolatum*)

Common thistle, Roadside thistle



DOG FENNEL



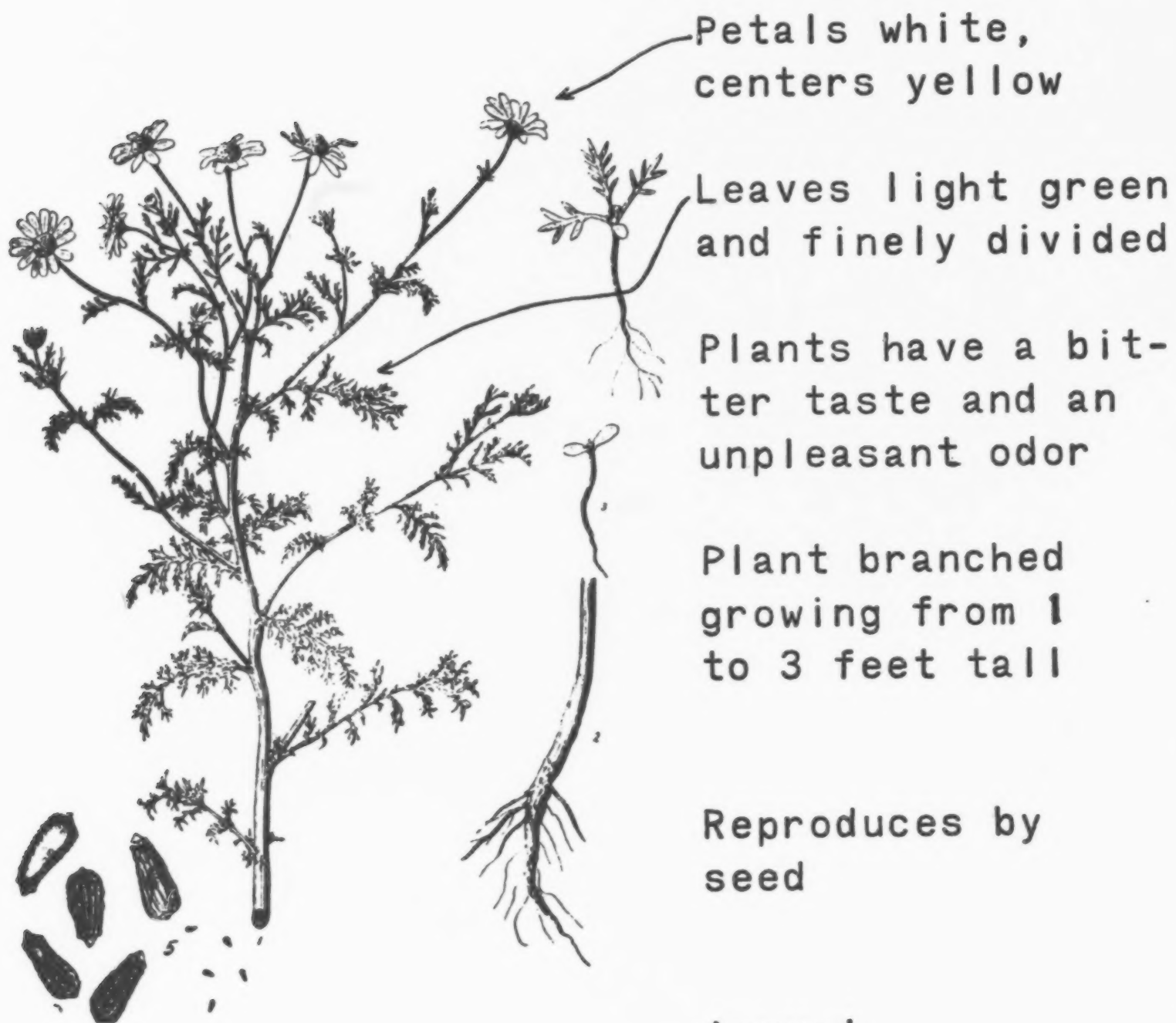
LEAF



SEED

DOG FENNEL

(*Anthemis cotula* L.)
Mayweed, Field camomile



Petals white,
centers yellow

Leaves light green
and finely divided

Plants have a bit-
ter taste and an
unpleasant odor

Plant branched
growing from 1
to 3 feet tall

Reproduces by
seed

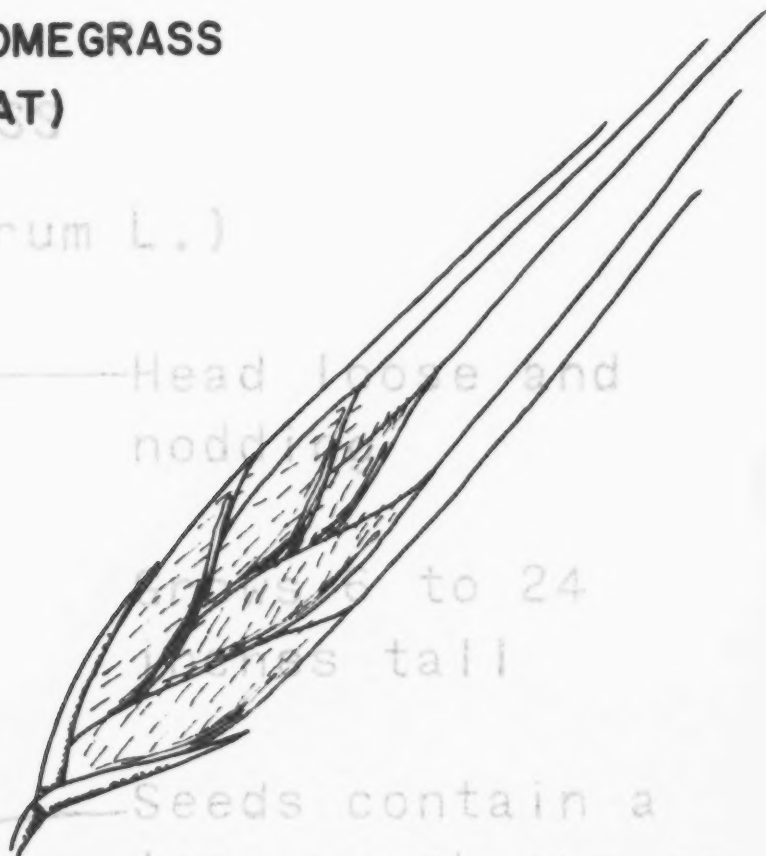
Annual

DOWNY BROMEGRASS **(CHEAT)**

(*Bromus tectorum* L.)



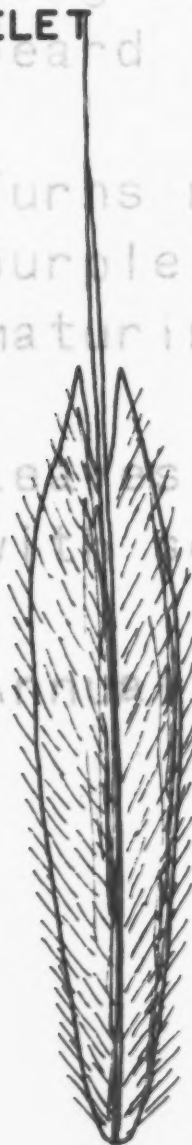
INFLORESCENCE



SPIKELET



SEED



180

Head loose and
noddish

to 24
inches tall

Seeds contain a
long rough awn or
beard

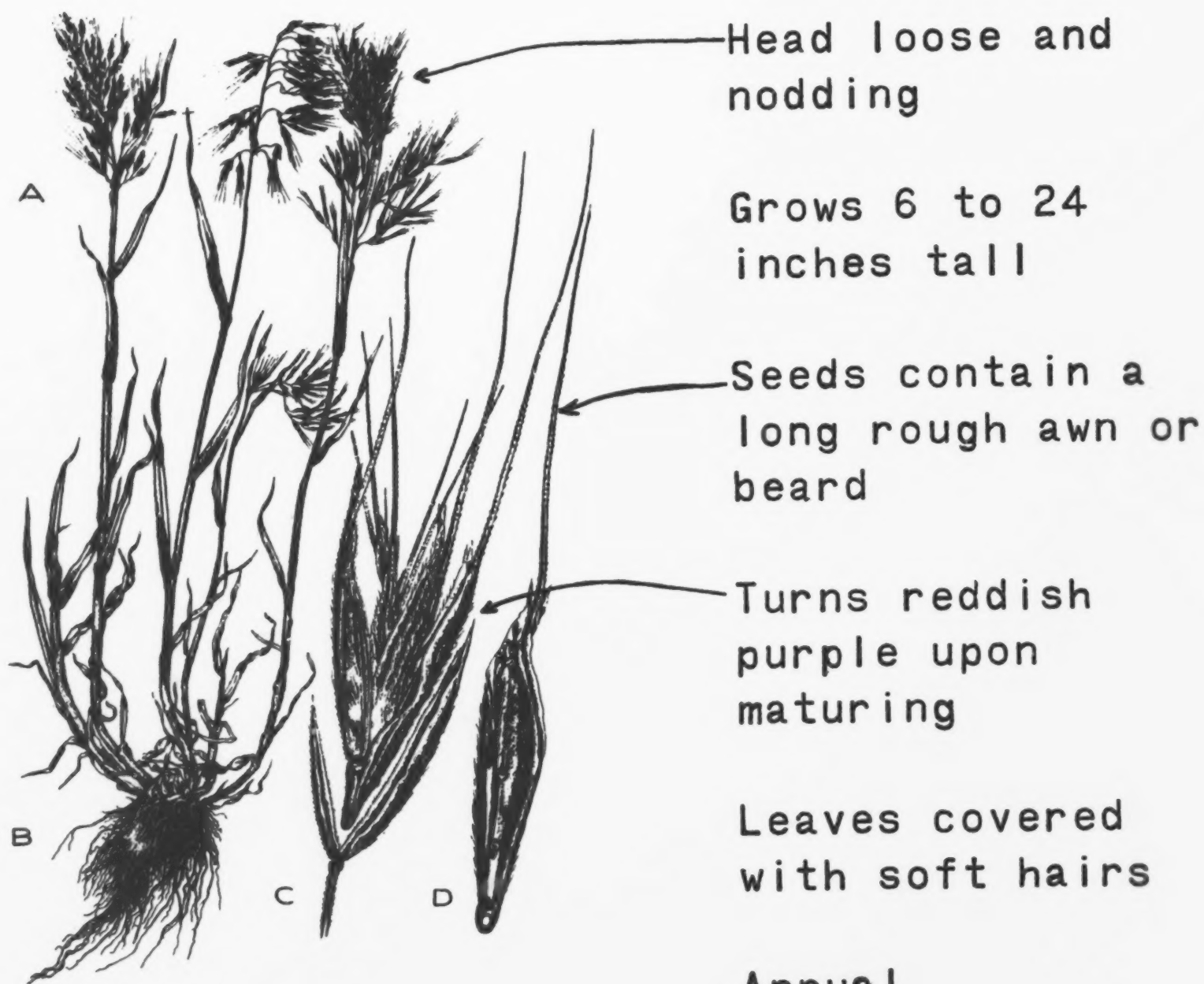
Turns reddish
purple upon
maturing

Leaves covered
with soft hairs

Awns

CHEATGRASS

(*Bromus tectorum* L.)



Head loose and nodding

Grows 6 to 24 inches tall

Seeds contain a long rough awn or beard

Turns reddish purple upon maturing

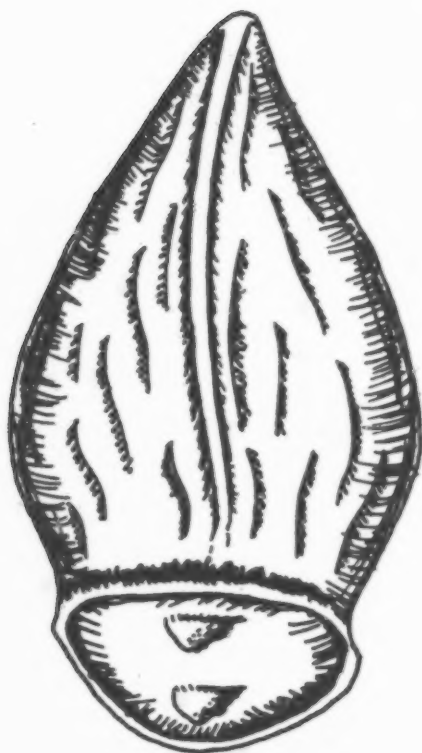
Leaves covered with soft hairs

Annual

GROMWELL

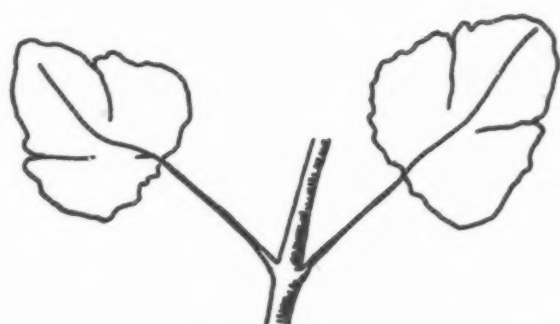


LEAVES



SEED

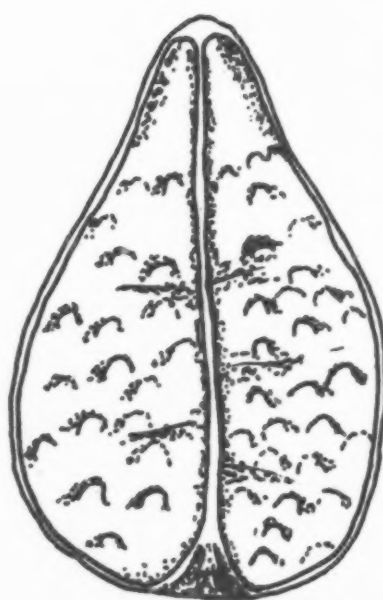
HENBIT



LOWER LEAVES



UPPER LEAVES

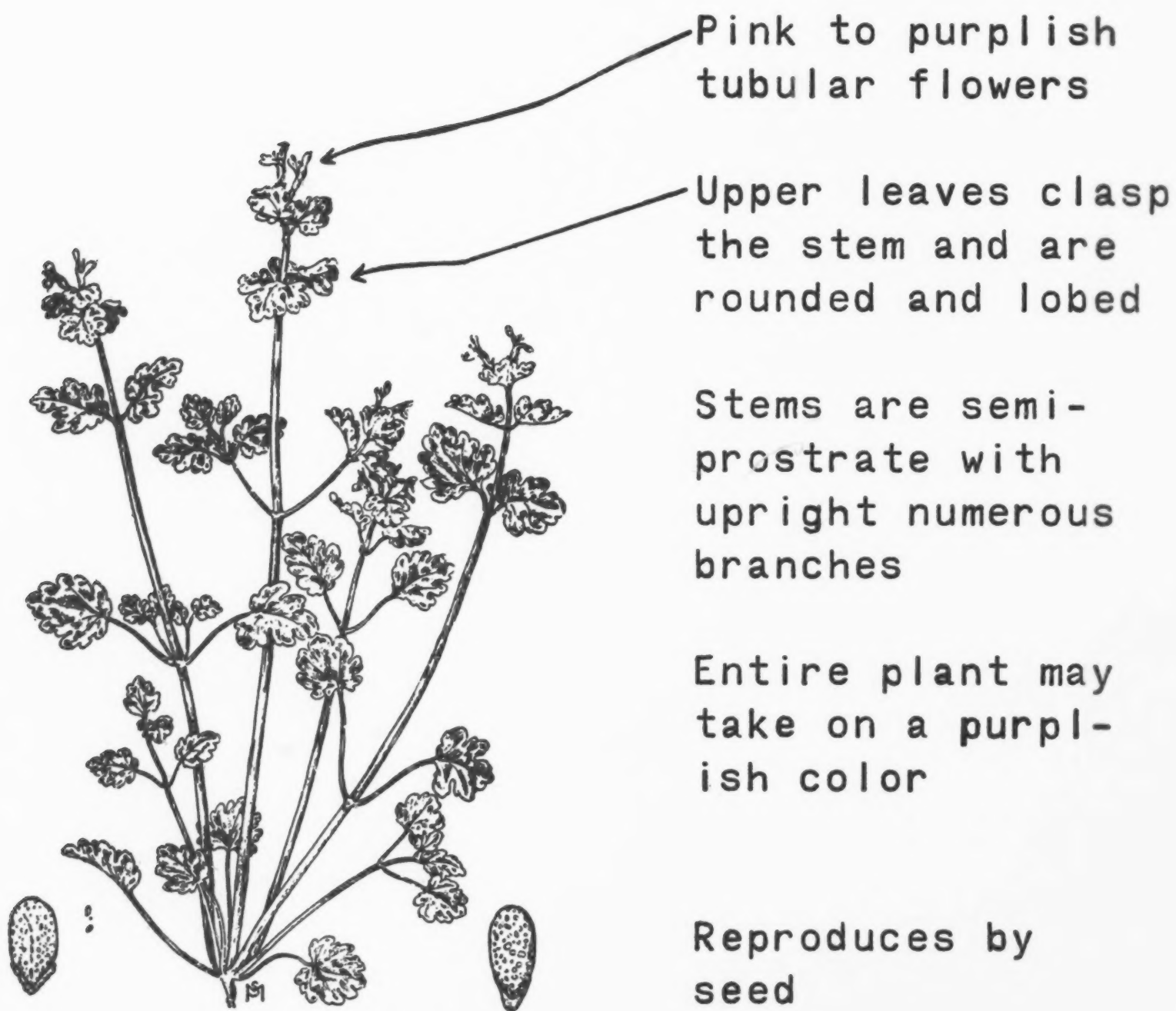


SEED

HENBIT

(*Lamium amplexicale* L.)

Dead nettle



Pink to purplish
tubular flowers

Upper leaves clasp
the stem and are
rounded and lobed

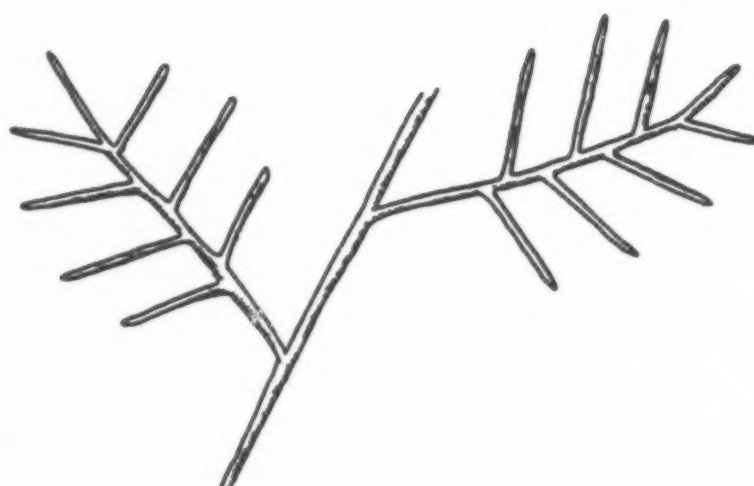
Stems are semi-
prostrate with
upright numerous
branches

Entire plant may
take on a purpl-
ish color

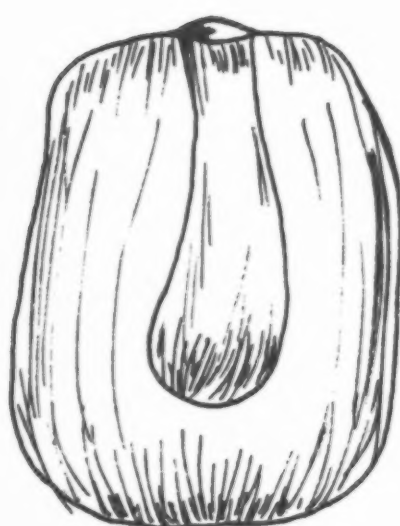
Reproduces by
seed

Annual or bien-
nial

JIM HILL MUSTARD

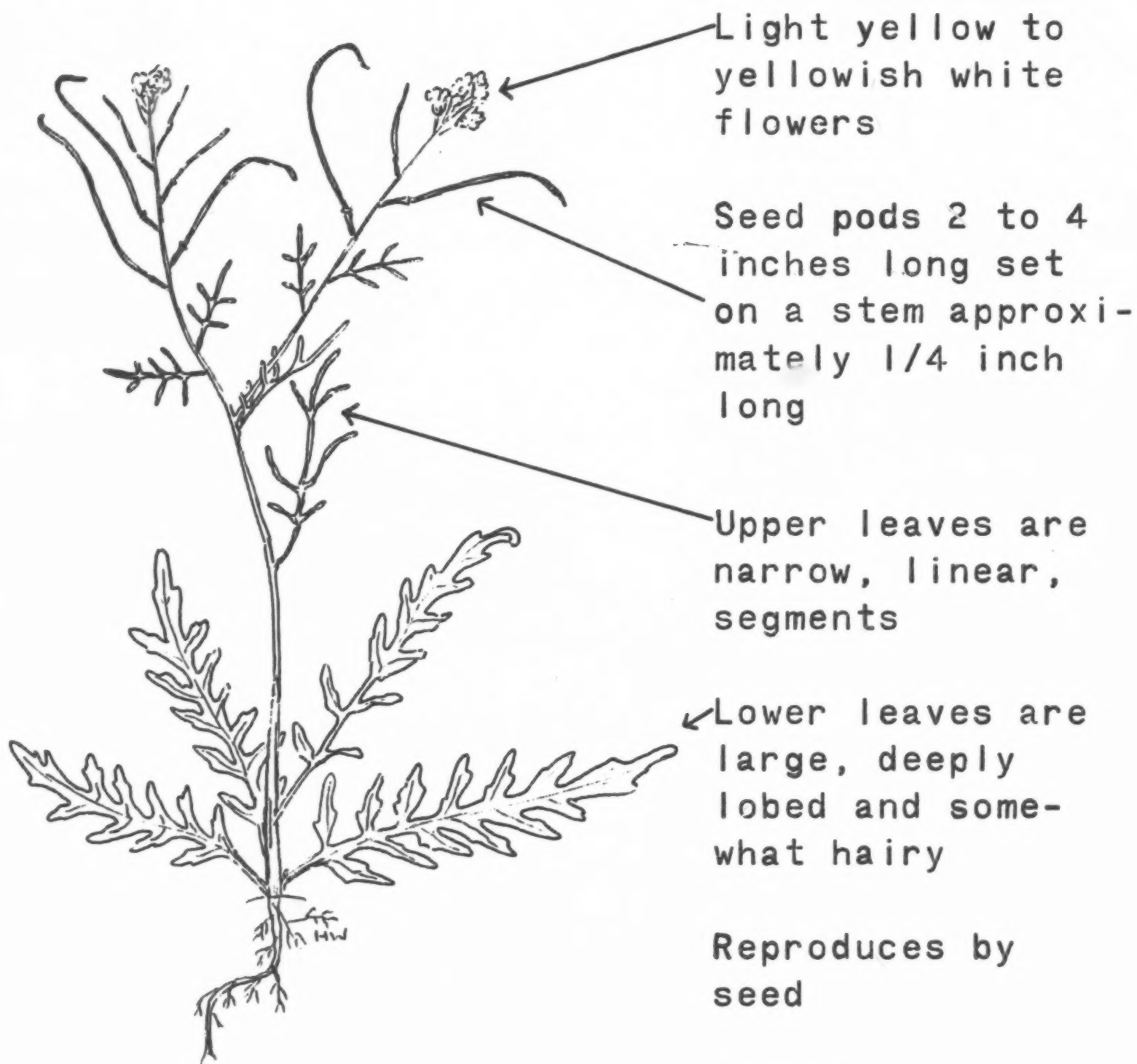


LEAVES



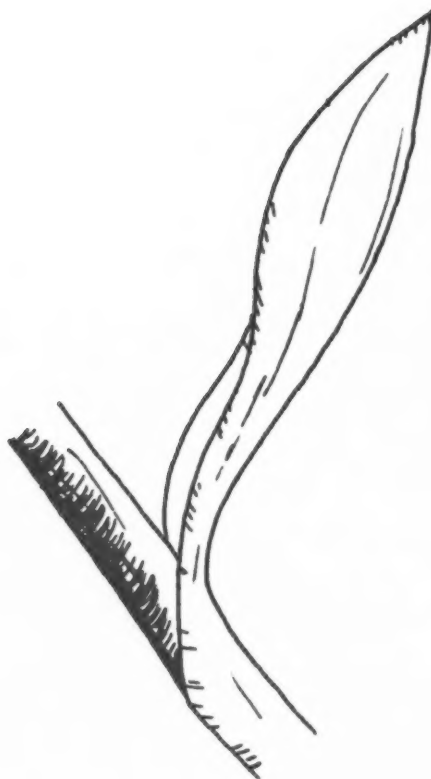
SEED

JIM HILL MUSTARD
(*Sisymbrium altissimum*)
Tumbling mustard

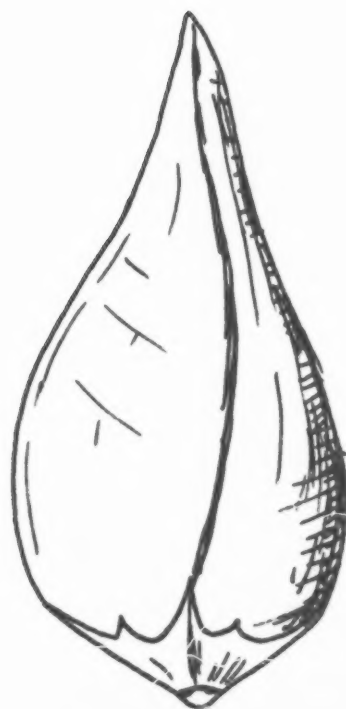


Annual

KNOTWEED



LEAF

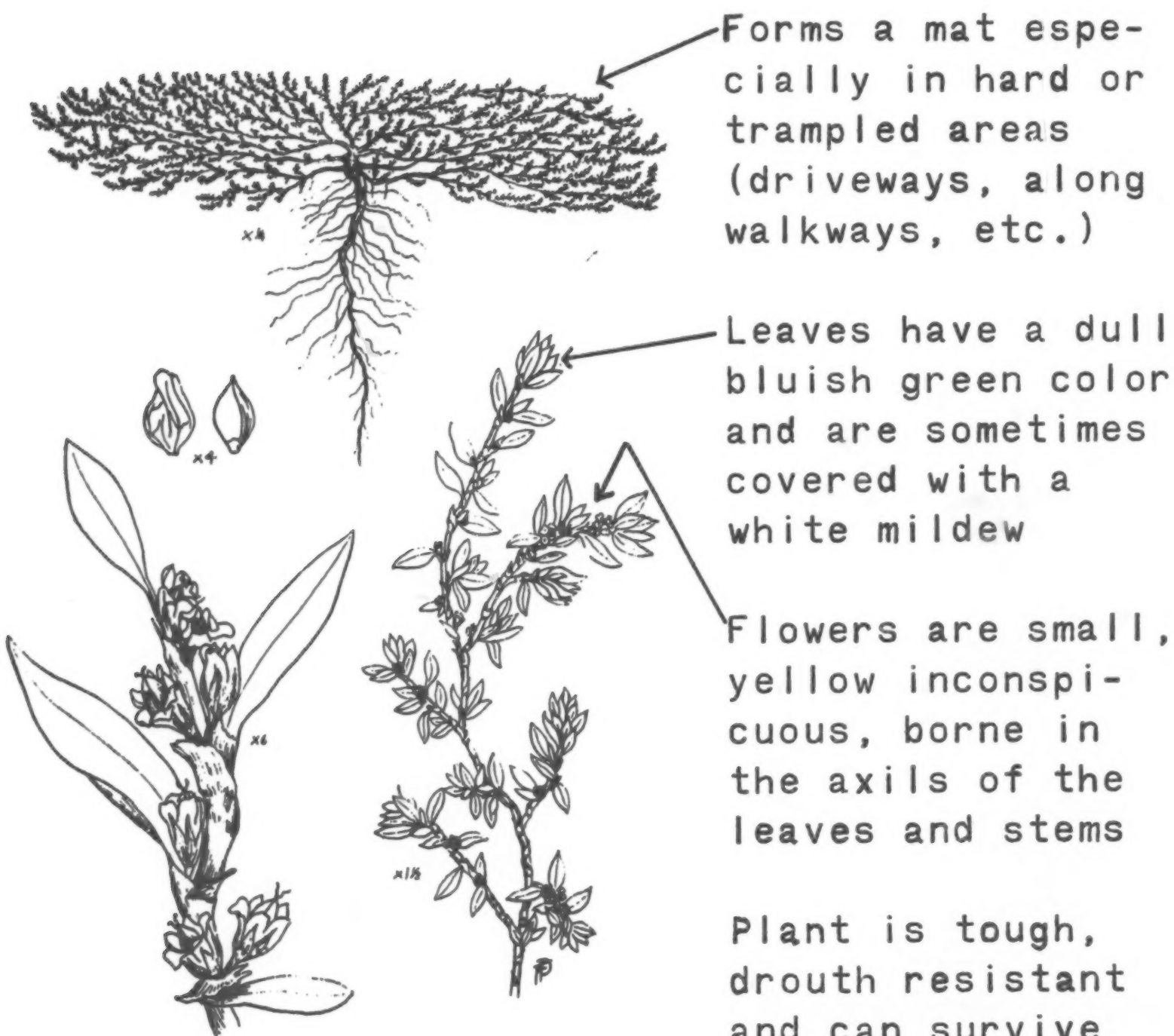


SEED

PROSTRATE KNOTWEED

(*Polygonum abiculare* L.)

Knotgrass, Matweed



Forms a mat especially in hard or trampled areas (driveways, along walkways, etc.)

Leaves have a dull bluish green color and are sometimes covered with a white mildew

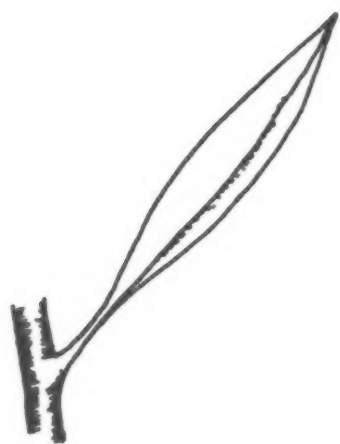
Flowers are small, yellow inconspicuous, borne in the axils of the leaves and stems

Plant is tough, drouth resistant and can survive a great deal of abuse

Reproduces by seeds

Annual

LAMBS-QUARTERS



UPPER LEAF

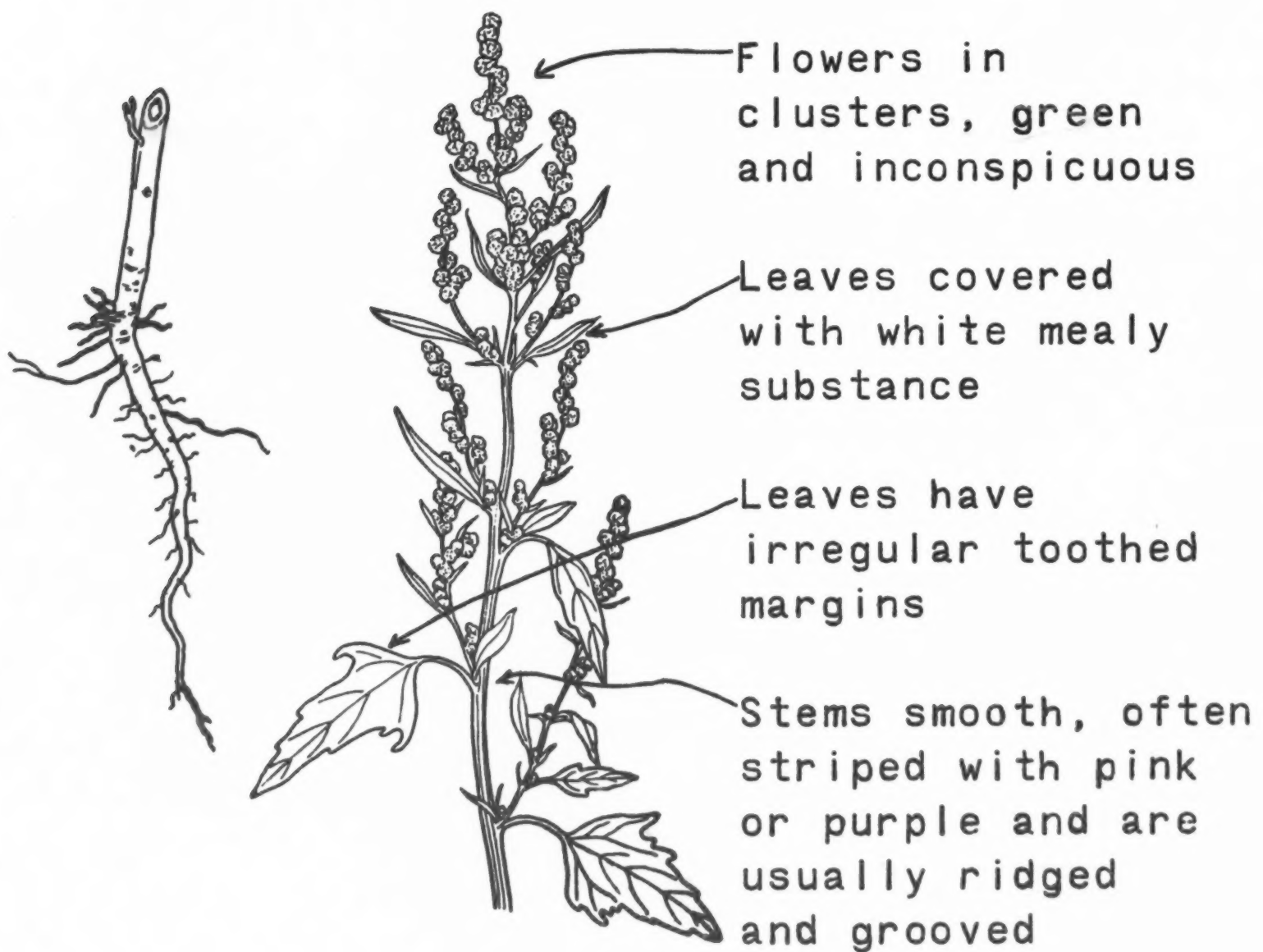


LOWER LEAF



SEED

LAMBS-QUARTERS
(*Chenopodium album* L.)
Pigweed

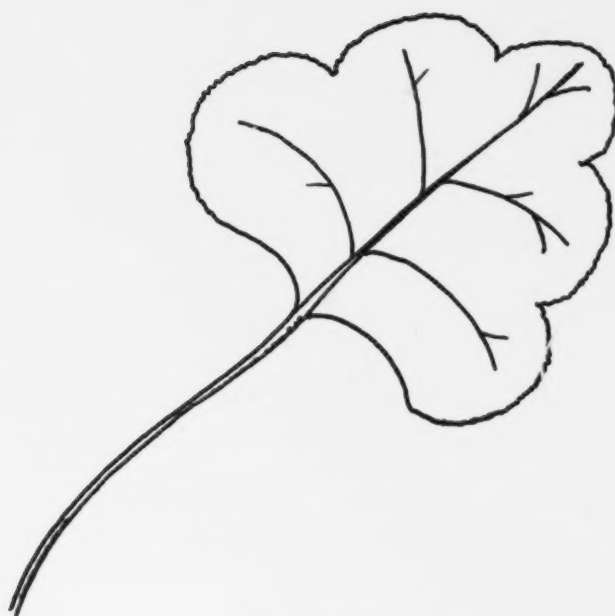


Plant grows from
1 to 6 feet high

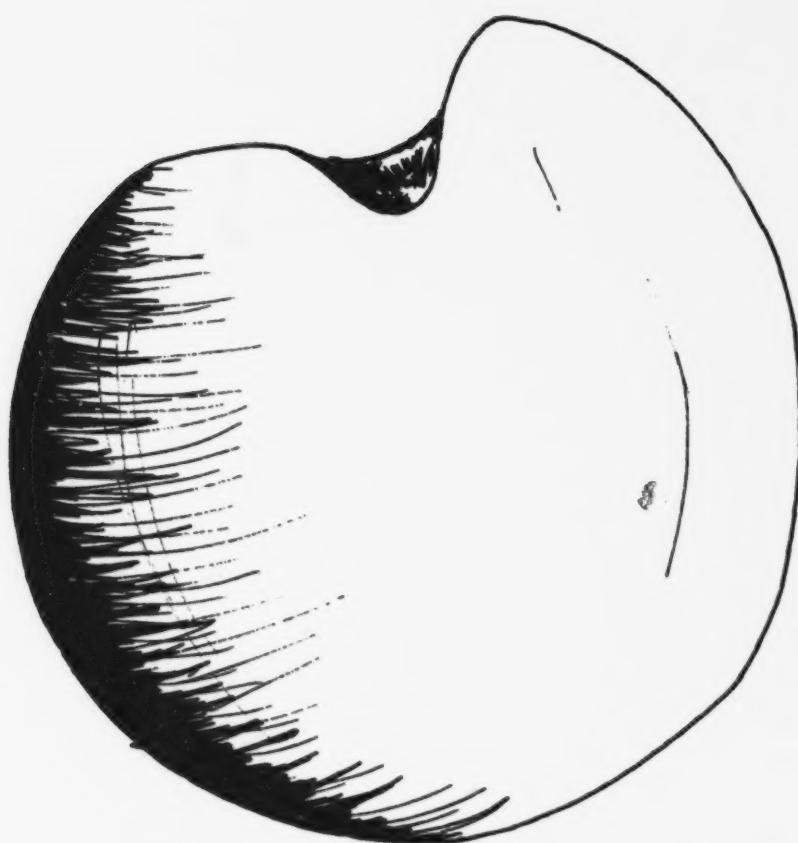
Reproduces by
seed

Annual

MALLOW

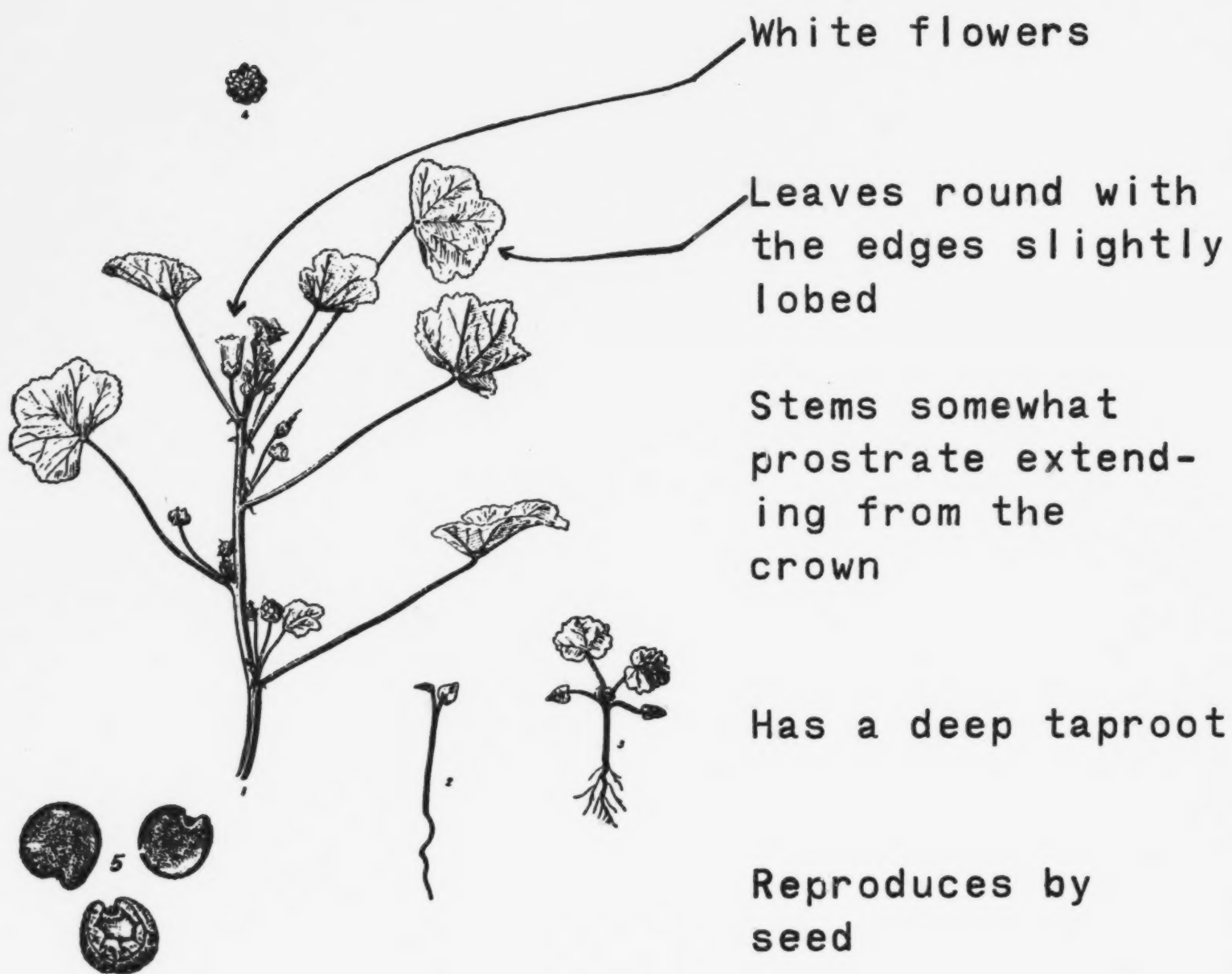


LEAF



SEED

MALLOW
(*Malva rotundifolia* L.)
Buttonweed, Cheeseweed



White flowers

Leaves round with
the edges slightly
lobed

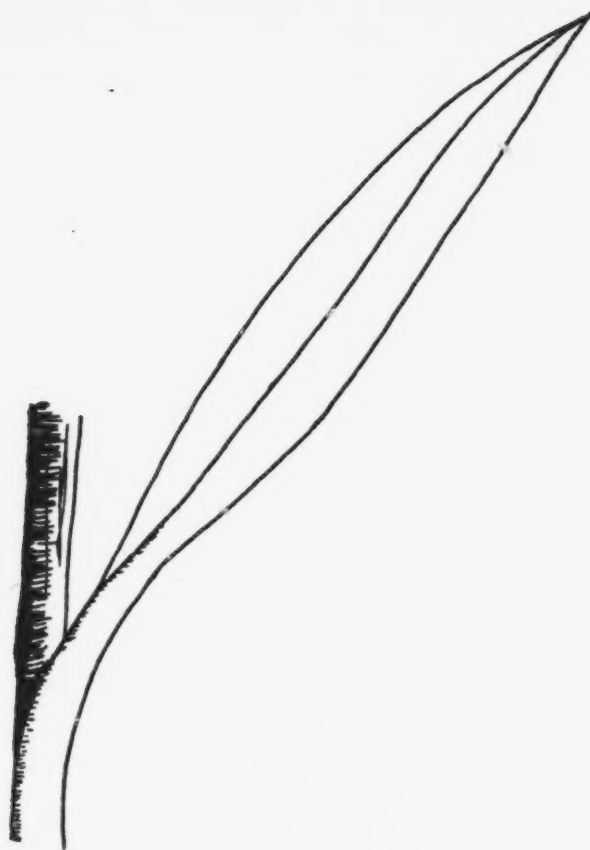
Stems somewhat
prostrate extend-
ing from the
crown

Has a deep taproot

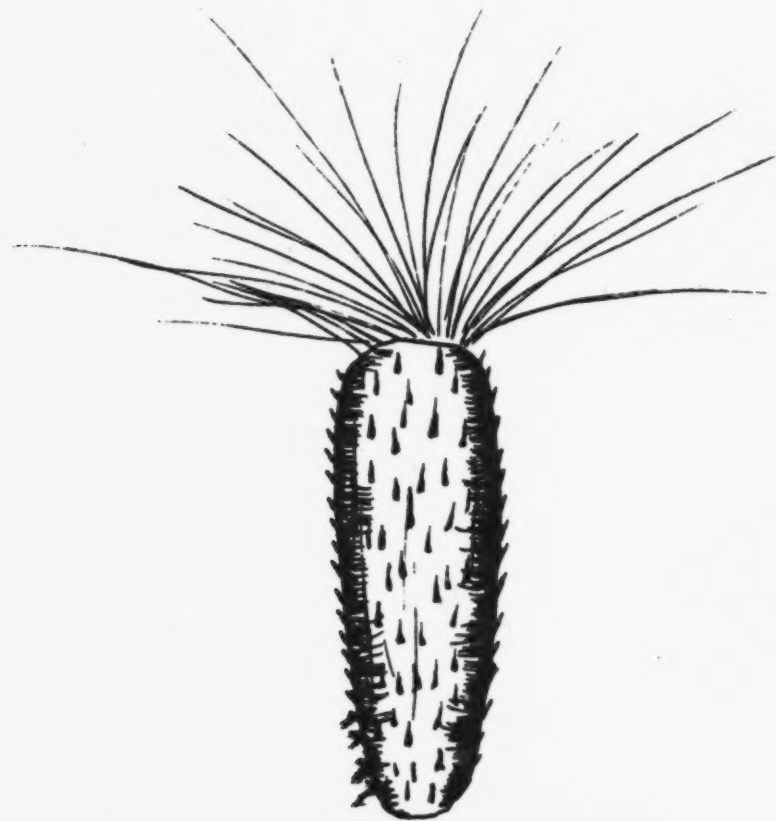
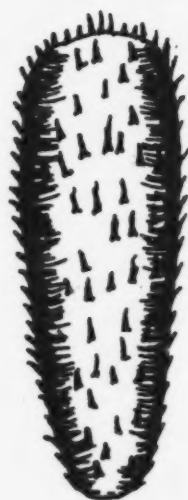
Reproduces by
seed

Annual, biennial
and possibly
perennial

MARES-TAIL



LEAF

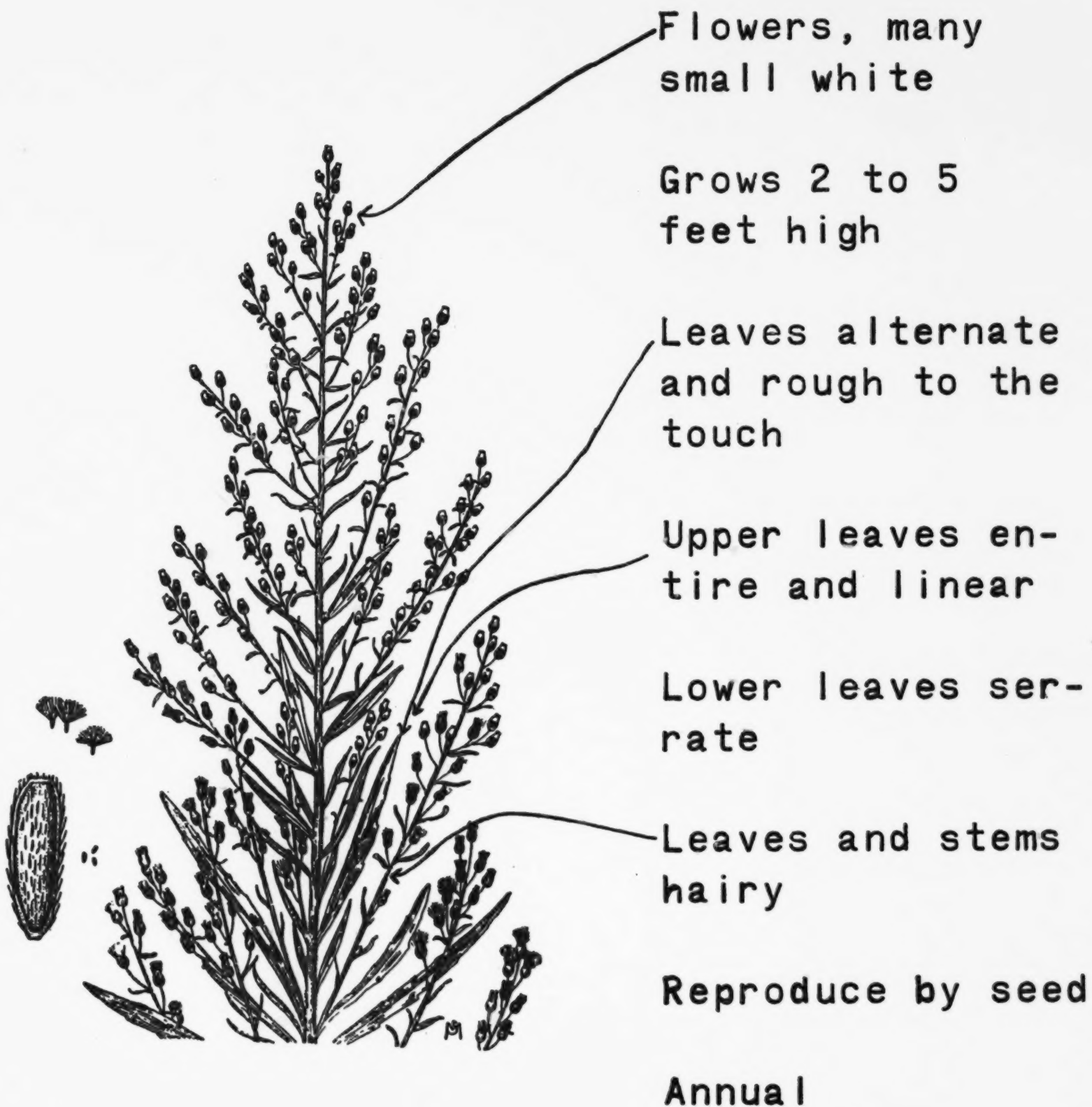


SEED

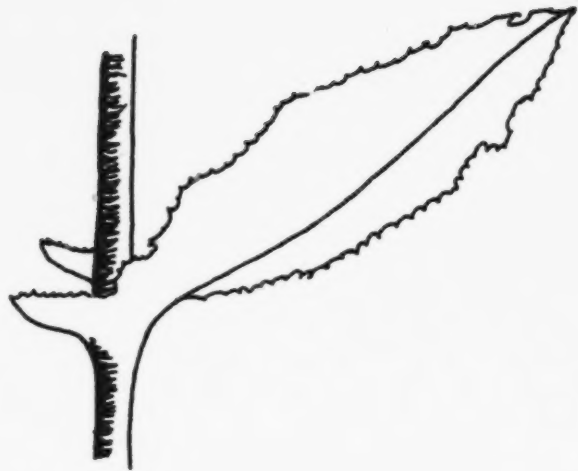
MARES-TAIL

(*Eriqeron canadensis* L.)

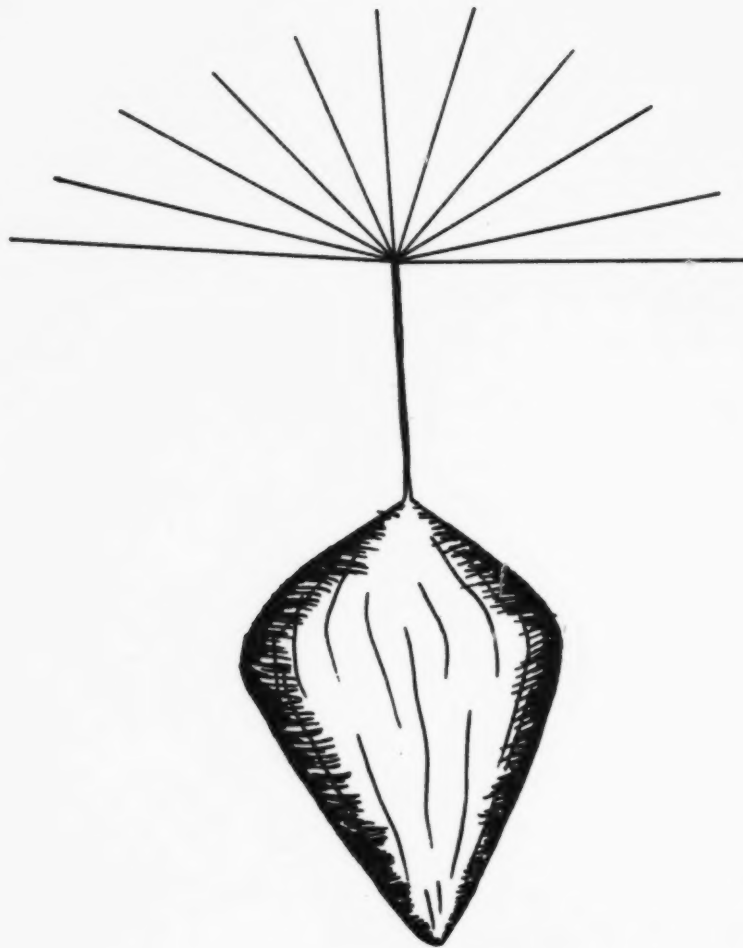
Canada fleabane, Horseweed



PRICKLY LETTUCE



LEAF

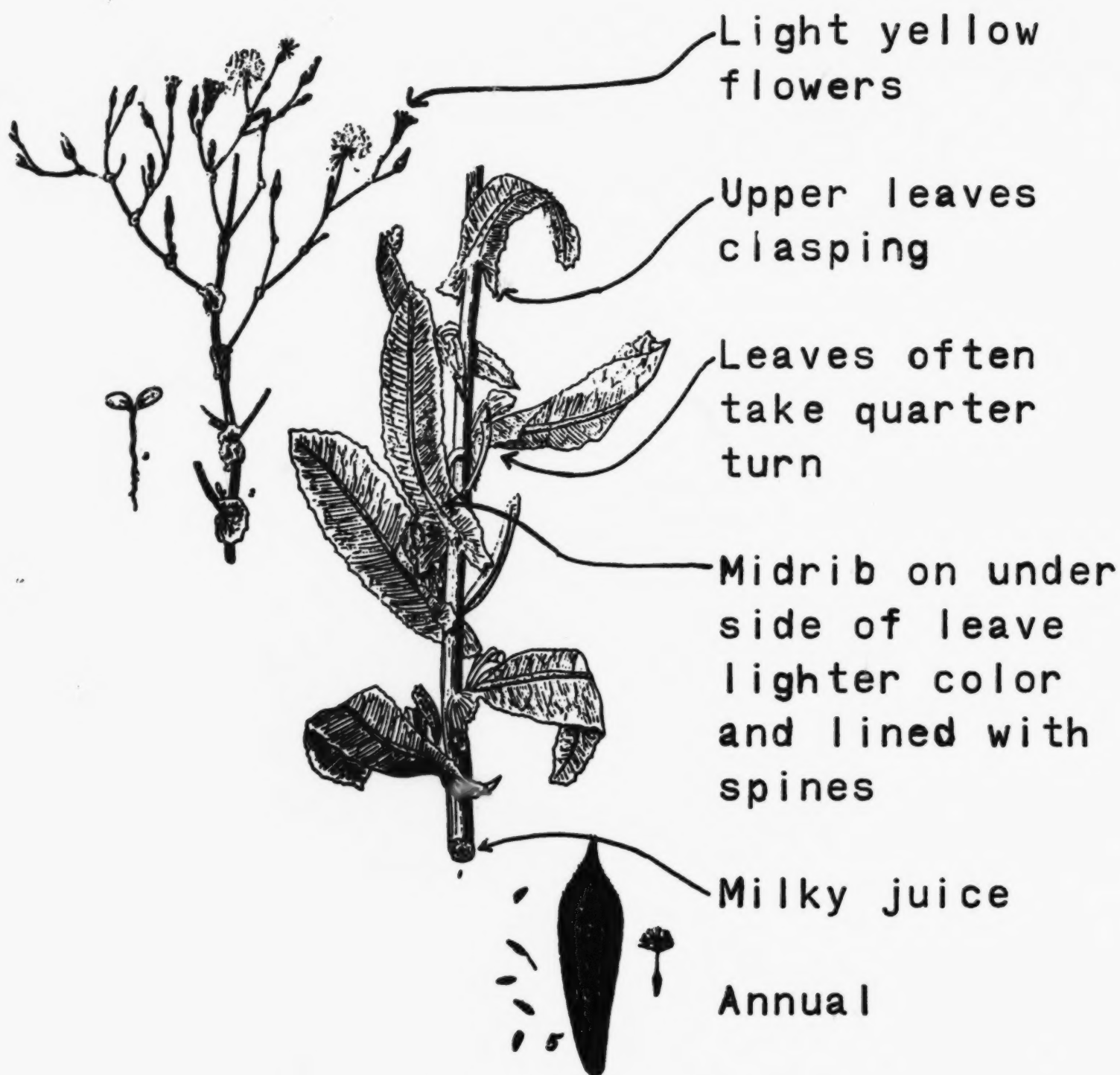


SEED

CHINA LETTUCE

(*Lactuca scariola* L.)

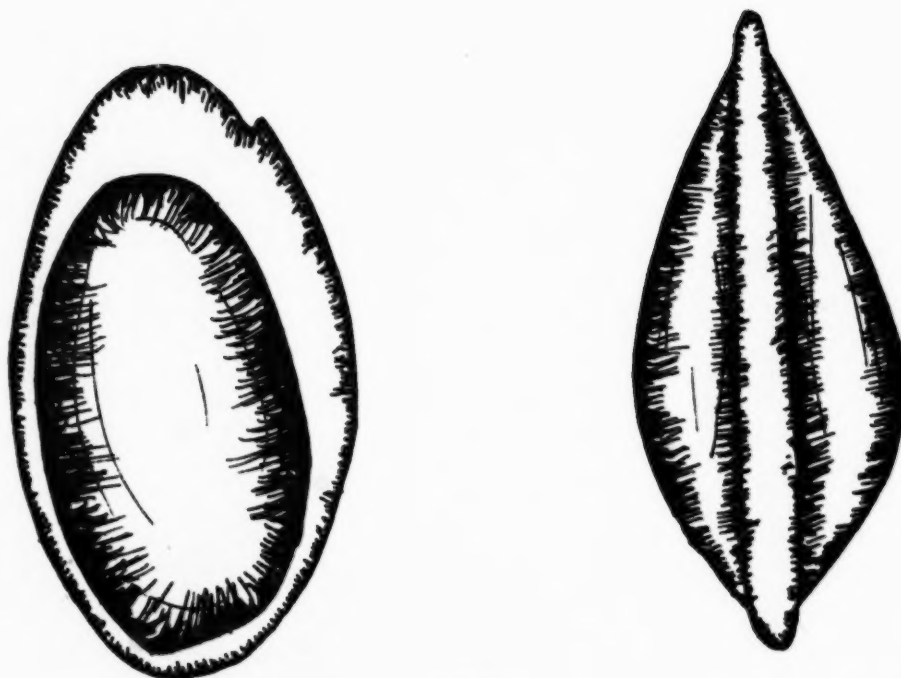
Prickly lettuce, Wild lettuce



ROUGH PIGWEED



LEAF

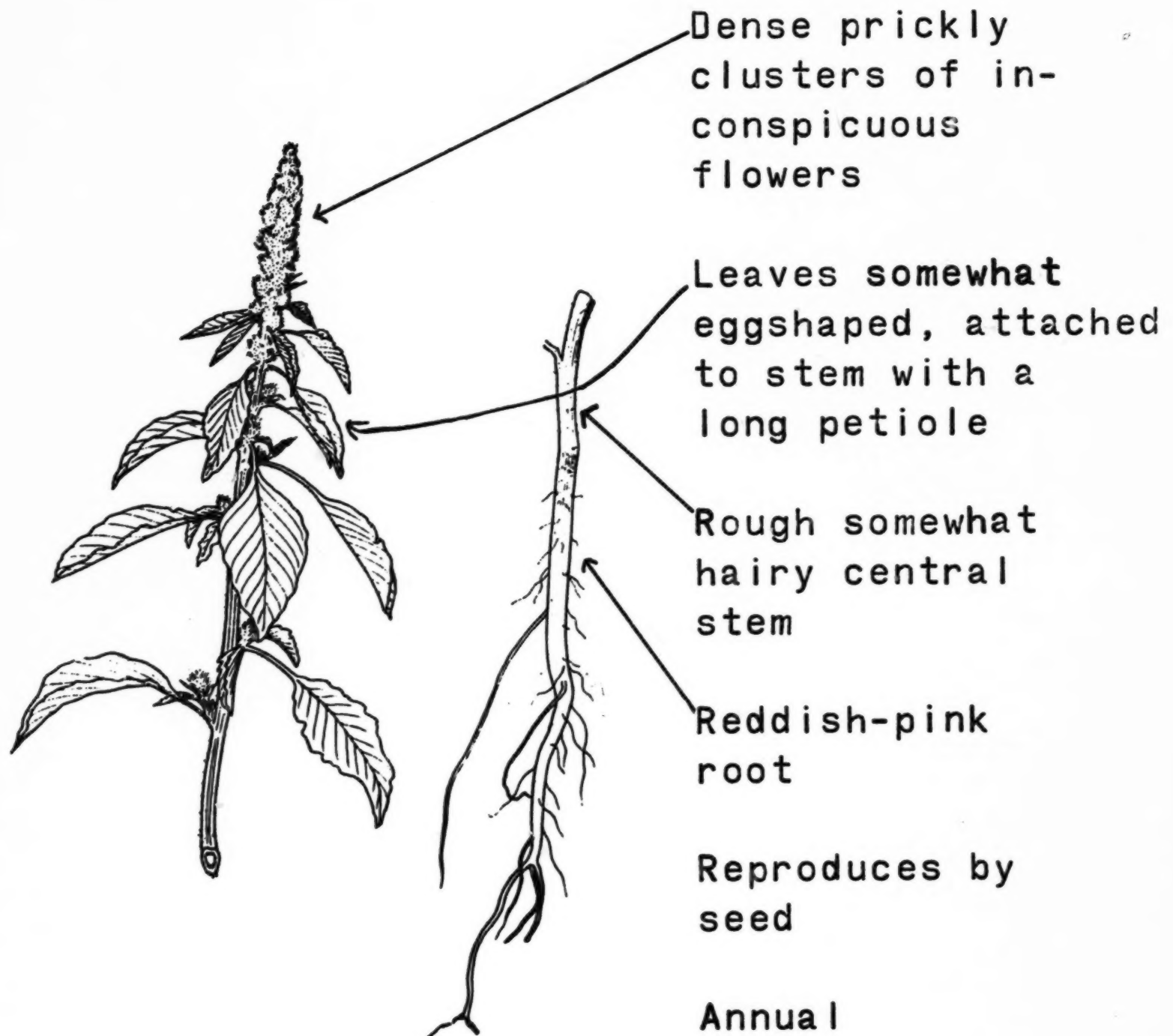


SEED

PIGWEEED

(*Amaranthus retroflexus* L.)

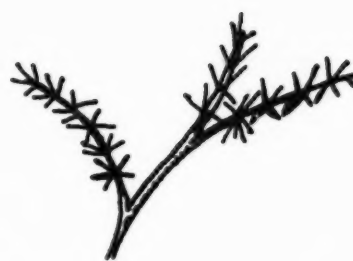
Redroot



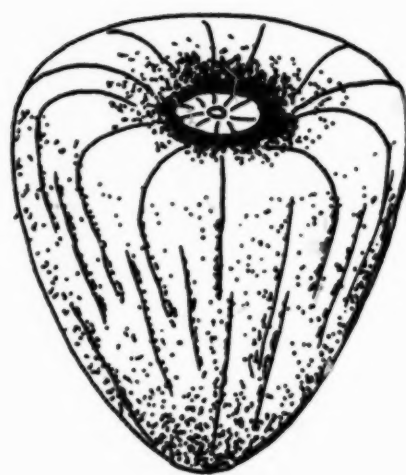
RUSSIAN THISTLE



YOUNG LEAF



MATURE LEAF



SEED

RUSSIAN THISTLE

(*Salsola pestifer* A. Nels)

Tumbleweed

Light pink to green (inconspicuous) flowers produced in the axils of leaves and stems



Young plants are succulent and fleshy

Extensively branched, bushy growth

Purple or reddish strips on stems

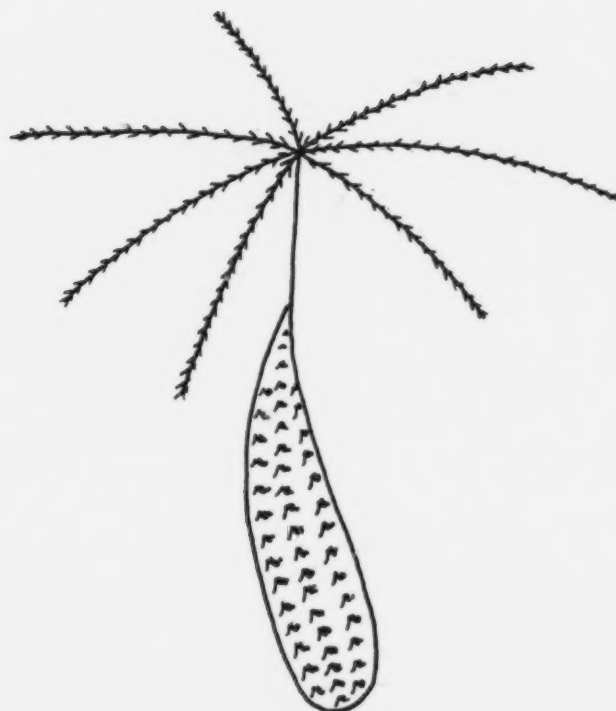
Pest becomes sticky at maturity

Annual

SALSIFY



LEAF



SEED

WILD SALSIFY

(*Tragopogon pratensis* L.)

Oyster plant, Goatsbeard



Yellow or purplish
blue flower

Seed head forms
large white puff
ball

Leaves long and
linear almost
"grass-like"

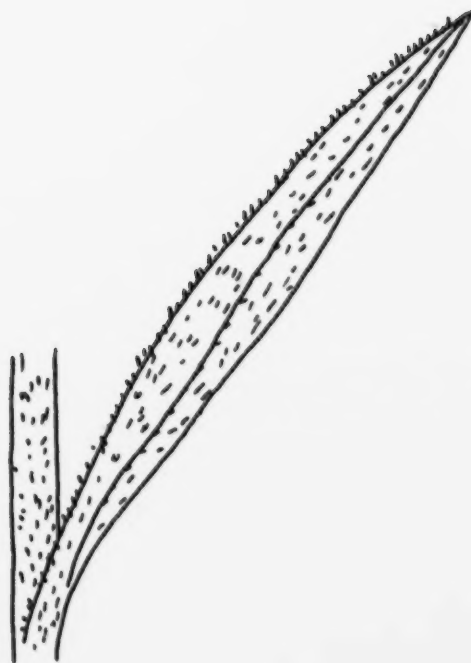
Plant smooth and
contains a bitter,
white milky juice

Plant has a deep
fleshy taproot

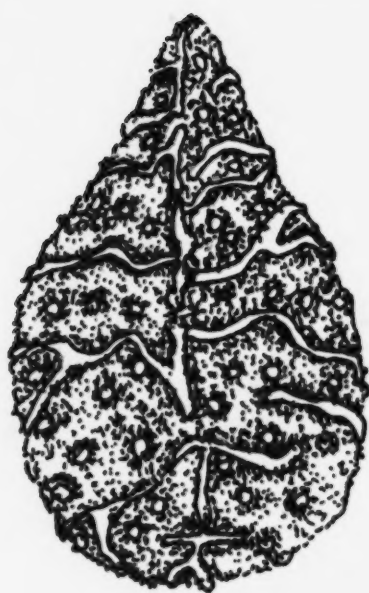
Reproduces by seed

Biennial

TARWEED



LEAF

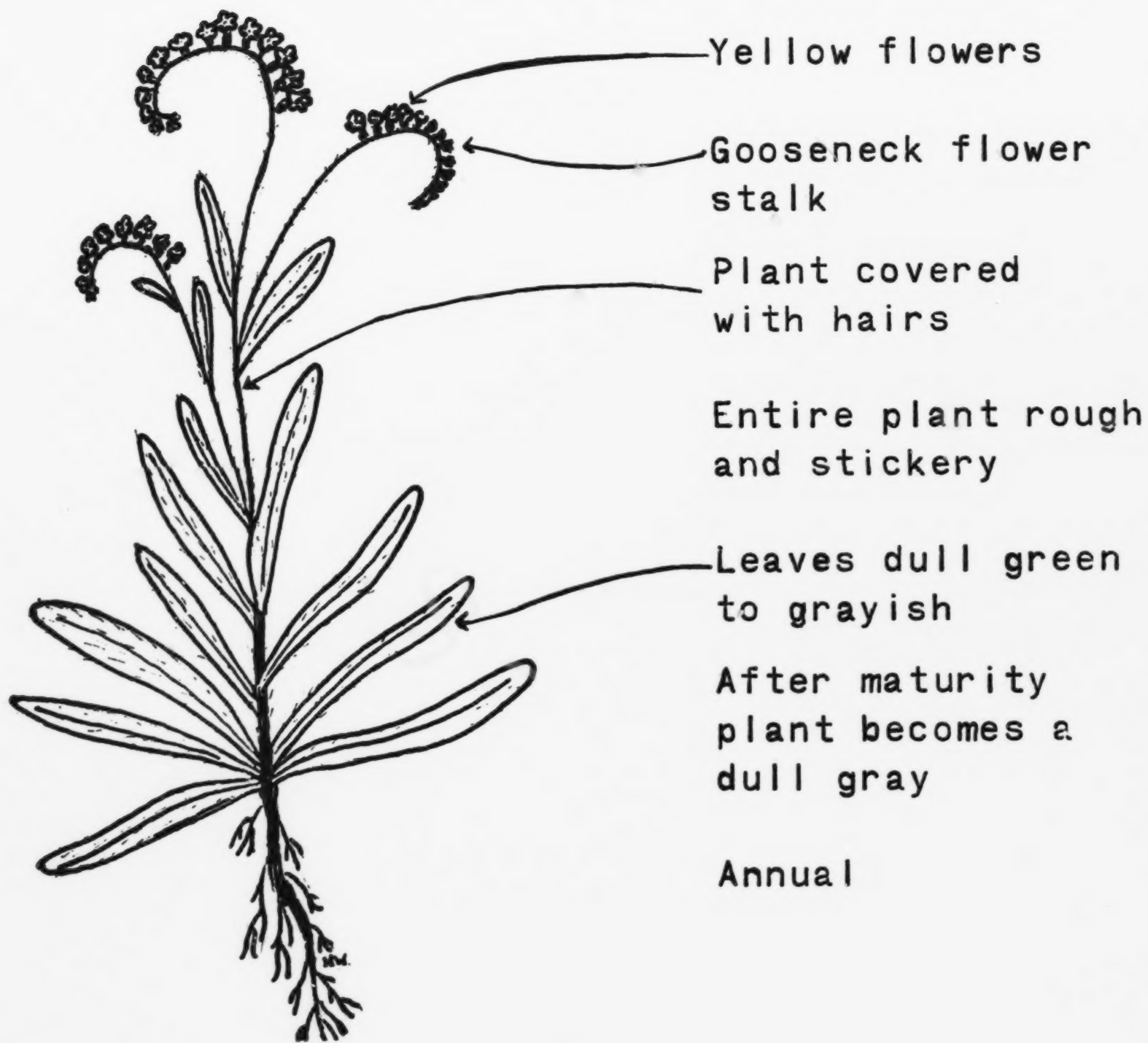


SEED

TARWEED

(*Amsinckia intermedia* F and M)

Fiddleneck



WILD BUCKWHEAT



LEAF



SEED

WILD BUCKWHEAT

(*Polygonum convolvulus*)

Black bindweed



Flower incon-
spicuous borne
in clusters on
flower stalks

Leaves arrow or
heartshaped

Stems long, twin-
ing or trailing

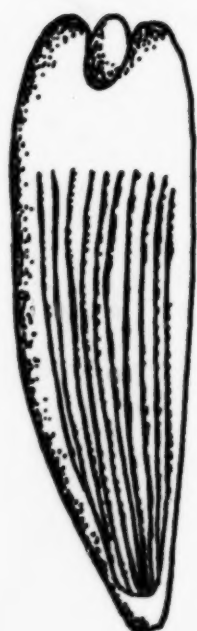
Reproduces by
seed

Annual

YARROW



LEAF

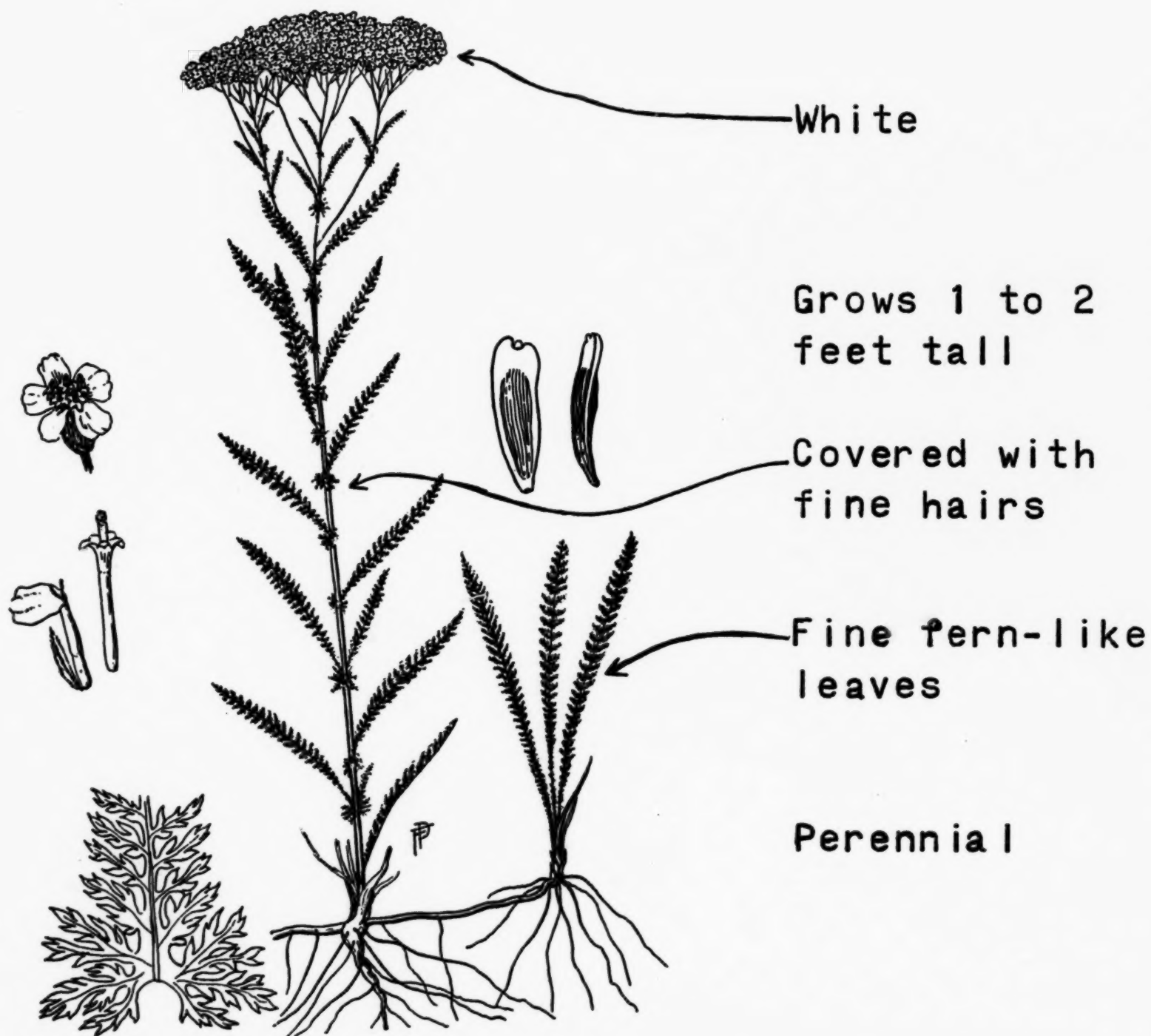


SEED

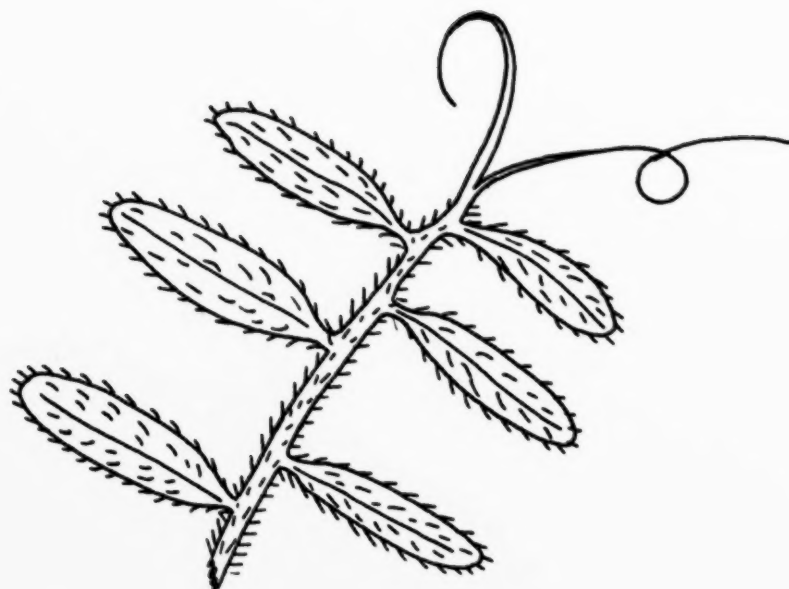
YARROW

(*Achillea millefolium* L.)

Milfoil, Thousand-leaf



HAIRY VETCH



LEAF



SEED

APPENDIX

APPENDIX A

This letter is being sent state-wide to the Vocational Agriculture departments in Washington. Would each of you consider for a moment what visual aids would be most beneficial to you in your respective Agronomy or Crops teaching programs. Coordinated efforts between the Agronomy Department and Division of Agricultural Education at WSU are being attempted in hopes of compiling visual aids for instructional use in the field of Agronomy. These aids may be in the form of 2 x 2 slides, transparencies, charts, workbooks, etc.

The purpose of this letter is to ascertain which areas of Agronomy should be emphasized based on the major requests of this survey. In this way visual aids of the most significance can be prepared.

As an example one area which may be applicable, would be 2 x 2 slides and transparencies regarding crop seed judging and identification characteristics of crops appearing on the state identification list. These could include diagrams or actual photos of seed quality, seed damage and other factors used in pan seed judging. Slides could be prepared of crop and weed seeds and seedlings for identification purposes. Other areas which can be diagrammed quite well by visual aids are the overall plant growth pattern and plant reproduction as pertaining to crop species.

Please compile your list in order of preference of about ten general headings in the Agronomic field and forward to the following address as soon as possible:

Gilbert A. Long, Agricultural Education
Washington State University, Pullman, Washington 99163

Let me suggest that you look at the two transparency master publications as you consider this request. Any transparency masters that you have individually developed would be welcomed.

Sincerely yours,

Dwane G. Miller
Assistant Professor of Agronomy

Gilbert A. Long
State Supervisor
Agricultural Education

DGM/GAL:sa

APPENDIX B

Questionnaires Sent to Teachers to Obtain
Evidence Regarding Usefulness of Masters

Dear _____:

Have you used masters from "Transparency Masters for Agriculture
(Supplement)"?

YES _____

NO _____

Do you have dry copy equipment available?

YES _____

NO _____

Do you have Diazo process equipment available?

YES _____

NO _____

Which areas have you used most often?

Soils and Fertilizers	YES _____	NO _____
-----------------------	-----------	----------

Horticulture	YES _____	NO _____
--------------	-----------	----------

Animal Reproduction	YES _____	NO _____
---------------------	-----------	----------

Feeding	YES _____	NO _____
---------	-----------	----------

Arc Welding	YES _____	NO _____
-------------	-----------	----------

Future Farmers of America	YES _____	NO _____
---------------------------	-----------	----------